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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 1005

Contribution from the Bureau of Soils
MILTON WHITNEY, Chief

Washington, D. C. ▼ April 24, 1922

SOILS OF EASTERN VIRGINIA AND THEIR USES FOR TRUCK CROP PRODUCTION

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By

J. A. BONSTEEL, Scientist in Soil Survey

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WASHINGTON
GOVERNMENT PRINTING OFFICE
1922

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INTRODUCTION.

Two distinct and separate localities in eastern Virginia have been developed for the production of special vegetable crops for shipment to outside markets and commonly known as truck crops.

The first and oldest of these, the Norfolk district, lies to the south of the James River, eastward from the vicinity of Suffolk to the Atlantic Ocean. The other, the Eastern Shore district, of more recent development, occupies a large proportion of Accomac and Northampton, the two Eastern Shore counties of Virginia. The two districts are separated by the lower stretches of Chesapeake Bay and present certain distinctive natural aspects. They possess the common characteristics of being located in close proximity to tidewater, of lying at low elevations which range from sea level to extreme altitudes of about 50 feet above tide with the greater part of the total land surface at elevations of 15 to 40 feet, of being well located with respect to shipping facilities, and of experiencing a long growing season.

Since the two districts differ in detail in regard to certain of these factors, it is necessary to describe them separately.

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THE NORFOLK TRUCKING DISTRICT.

LOCATION.

The Norfolk trucking district is located chiefly within the northern parts of Isle of Wight, Nansemond, Norfolk, and Princess Anne Counties, Va. Even within these counties the production of truck crops is distinctly localized to positions near tidewater, extending from the Lynnhaven River on the east to the Nansemond River on the west. By far the greater part of the land used for the growing of truck crops and strawberries lies north of a line drawn from Princess Anne courthouse to Suffolk, Va., and east of a line drawn thence northward to the James River, near Smithfield. Small areas producing truck crops are also found in James City, York, Warwick, and Elizabeth City Counties, but these lie across the James River and outside the limits of the Norfolk district in its more restricted sense.

Only a small proportion of the total land area of the counties of eastern Virginia lying south of the James River and Chesapeake Bay is given to truck crop production. It is impossible to state with exactness the actual acreage devoted to this form of agriculture, as the area varies from year to year and certain duplications in cropping prevent the making of a precise estimate of the land thus employed.

The climatic conditions in the vicinity of Norfolk permit the growing of a succession of crops during the year, and the same land is frequently used for the growing of two or more crops within the same year. In consequence the total acreage of vegetables will undoubtedly exceed by many acres the total area devoted to truck crop production. The winter areas of spinach and kale are duplications of acreages used for the growing of spring truck crops. Similarly, certain crops are extensively interplanted, as in the case of beans and peas with strawberries, peas with cucumbers, potatoes with newly set beds of strawberries, and other less frequent combinations. (See Pl. I, figs. 1 and 2.)

It is probable that some 5,000 acres of duplication should thus be allowed for and that the total land area used for truck crop production in the Norfolk district annually during recent years is about 50,000 acres.

It is evident, therefore, that only a small part of the area included in the district is actually used for truck crop production. The reasons for this limitation are local conditions of soil texture, drainage, transportation facilities, and minor climatic variations.

CLIMATE.

The Norfolk trucking district constitutes the most northern area where it is the common practice to produce vegetable crops throughout the year for shipment to more northern markets. Ability to follow this practice is dependent upon local climatic conditions to a considerable degree. The district lies at a low elevation contiguous to large areas of tidewater and approximately in latitude 36° 30′ to latitude 37° north.

According to the records of the United States Weather Bureau for the Norfolk station, the region has an annual mean precipitation of 49.29 inches, well distributed throughout the year, and the mean annual temperature is 59.2° F. There is an average annual snowfall of 9.4 inches, which occurs almost entirely in December, January, and February. The average date of the first killing frost in the fall is November 12 and of the last in spring March 27. Although killing frosts have occurred as early as October 15 and as late as April 26, in general a frost-free season of about 230 days would seem to be indicated. The winter conditions of temperature are such also that certain classes of vegetables, notably spinach, kale, and cabbage, may be grown throughout that season.

PRODUCTION, TRANSPORTATION, AND MARKETS.

Shipments of truck crops grown in this district are made to all the larger northern and northeastern cities. The district is served by several trunk lines of railroads and by half a dozen lines of steamboats which carry truck crops to Washington, Baltimore, Philadelphia, New York, Boston, and other northern cities. Locally the produce is collected for shipment by power boats, owned and operated by the different farmers or by others, by local steam and electric railroads, and to some extent through wagon haul to the shipping point. (See Pl. II, figs. 1 and 2.)

Two truck growers' associations manage the shipments of the greater part of the produce, and the figures for the total amounts of shipments for a series of years have been compiled by Prof. T. C. Johnson, director of the Virginia Truck Experiment Station. Table I shows the amount of these shipments from 1909 to 1914, inclusive. The figures are given for the trucking year, which terminates with August 31.

TABLE I.—*Annual shipments of truck crops, Norfolk district, Va., 1909 to 1914.*

Crop.	1909–10	1910–11	1911–12	1912–13	1913–14
Potatoes.....barrels..	934,592	587,141	1,051,651	946,550	817,972
Spinach.....do....	559,032	598,260	652,758	760,619	890,061
Kale.....do....	325,835	281,308	438,239	437,075	498,483
Cabbage.....do....	382,200	298,400	380,844	379,657	369,622
Sweet potatoes.....do....	70,463	52,003	68,145	41,406	47,805
Strawberries.....60-quart crates..	165,665	121,482	221,826	106,063	153,118
Beans.....baskets..	301,116	240,101	394,384	320,695	249,101
Peas.....{..do....	120,050	108,815	81,364	69,817	117,540
.....{barrels..	1,167	7,013	8,241	3,124	2,093
Cucumbers.....{.. do	124,501	92,853	68,947	111,339	122,193
.....{baskets..	38,656	41,886	46,945	65,994	41,109
Radishes.....do....	107,959	112,481	112,902	132,577	134,107
Lettuce.....do....	64,335	57,566	57,320	57,838	71,260
Beets.....crates..	12,739	8,878	7,492	13,884	16,928
Egg plant.....do....	29,418	19,900	27,113	34,389	16,735
Cantaloupes.....{..do....	35,354	44,284	14,190	27,113	19,525
.....{barrels..	296	51	17	.....	1,080
Tomatoes.....crates..	26,326	16,054	8,951	1,376	2,195
Cauliflower.....baskets..	8,106	12,366	5,242	16,953	19,540
Squash.....barrels..	10,825	12,156	5,096	14,688	8,681

In addition to these crops there were shipped appreciable quantities of asparagus, onions, peppers, parsley, carrots, turnips, and dandelion. Small shipments were also made of artichokes, cress, endive, okra, leeks, fennel, and celery.

PERIODS OF SHIPMENT OF TRUCK CROPS.

The continuous production of truck crops in the Norfolk district throughout the year and the realtive volume of production in the different seasons are indicated by the periods of normal shipment for the different important crops.

Irish potatoes are shipped from early in June to the middle or latter part of July. Usually the greater volume of shipment lies between June 10 and June 30.

Strawberries are shipped largely from the last of April to the middle of May, with shipments continuing until the end of that month.

Cabbage is shipped from about April 1 to the 10th of June.

Cucumbers, grown under sash, are shipped throughout the month of May, while the field-grown crop is marketed chiefly during June and July.

Radishes are shipped from early April to the 1st of July.

Lettuce is marketed during March and April, in the spring, and again from the latter part of September well into December, in the fall.

Egg plant is coming to be an important summer crop, marketed in the latter part of June, throughout July, and into August.

Cantaloupes are shipped from the latter part of June until a little past the middle of August.

Beets are shipped from the 20th of April until July.

Snap beans are shipped in the spring from about June to July 20 and in the fall during October and the early part of November.

Peas are marketed in the spring from the end of April to early June and in the fall from about September 20 to October 25.

Tomatoes from hothouses are marketed from just before Christmas throughout the winter months, and the field crop from the middle of June until the end of October.

Spinach is shipped from the last days of October throughout the winter months and until about the middle of April.

Kale is shipped from the 1st of November until the middle of April.

Sweet potatoes are shipped as they are dug, from the latter part of August to the end of October and from storage throughout the winter and early spring months well into April.

Aside from the hothouse and cold frame products, it is evident that the greater part of the shipments for the Norfolk district occur from the middle of April to the middle of August. Some crops are marketed until November, but the distinctly winter truck crops—spinach and kale—and such crops as are grown under hothouse conditions or may be stored constitute the bulk of the shipments from November 1 until well into April.

These facts, in conjunction with the figures giving the volume of shipment for the different crops, indicate that the Norfolk district is marked by year-round activity in trucking, but that the greater acreage and greater volume of business arise from the production of early spring and summer crops.

AGRICULTURAL POPULATION.

The business of truck crop production is chiefly in the hands of the native-born population of eastern Virginia and of a few individuals who have been attracted from other parts of the United States. The truck farms are operated either by their owners, by hired managers, or by tenants. Practically all of the labor is performed by colored laborers, including men, women, and the larger children, the women and children being employed at the lighter tasks at certain seasons of the year. A part of the labor is hired for extended periods (by the month or year), but a considerable volume of transient labor is also employed during the period of harvesting and marketing the principal crops.

PHYSICAL FEATURES.

The entire Norfolk trucking district lies within the Atlantic Coastal Plain. It is a region of low relief, no elevations greater than 30 feet above tide level occurring within Norfolk and Princess Anne Counties. Portions of Isle of Wight and Nansemond Counties rise to somewhat greater elevations.

If a line be drawn along the Nansemond River southward through Suffolk to the North Carolina boundary, it will be found that practically all of the territory lying to the east of this line lies at an

altitude ranging from 10 to 30 feet above tide level. The surface is very flat and all of the southwestern part of the section is occupied by the Dismal Swamp. The eastern and northern parts lying along the Nansemond River, James River, Elizabeth River and its branches, the Chesapeake Bay, and the Atlantic Ocean, occur at altitudes from tide level up to 25 or 30 feet. Although the surface is flat, the deep tidal indentations constitute natural drainage ways and a great part of the upland surface is fairly well drained under natural conditions.

It is a rather marked feature of the general surface of the section that the highest elevations of the upland occur along the northern border, frequently adjacent to the larger estuaries, and that the slight slope of the surface is toward the south and southeast.

Thus the outer rim of the section has the best natural drainage both because of its proximity to the larger estuaries and the most pronounced drainage ways and because of slightly greater elevation above tide level than the lands more remote from tide water. This fact undoubtedly accounts to some degree for the greater development of trucking along tidewater than in interior localities.

The district is drained almost exclusively through the deeply indented and numerous tidal estuaries which penetrate the region to a depth of 5 to 10 miles from the actual coast line. These estuaries are usually bordered by steep slopes, and the upland rises to elevations of 10 to 15 feet almost directly from water level. The drainage of the level to slightly sloping uplands finds its way to the major streams through shallow and frequently poorly defined channels. The interstream areas are so flat that drainage is rather poorly established in areas more remote from the tidal channels.

Since drainage strongly influences the distribution of cropping, this fact is of considerable importance in determining the localization of crop production, especially of truck crops. Poorly drained lands remain in forest. Those of moderate natural drainage are used for the growing of staple farm crops. Only the best drained and warmest lands are utilized for the production of truck crops. In some cases tile underdrainage and in many cases open ditches are employed to improve local drainage conditions on the truck farms. Yet the preferred lands for truck-crop production are those which possess the best natural drainage.

SOILS.

All of the soils of the Norfolk district are derived from unconsolidated materials of the Coastal Plain region, ranging in texture from coarse gravelly sandy deposits or dune sand on the one hand to finer textured loams and silt loams on the other. Soils which consist chiefly of finely divided mineral matter cover all of the marginal areas, but soils with which are mingled varying amounts of dead

and decaying organic matter are extensively developed in and around the margins of the Dismal Swamp. In the latter area there are extensive areas which consist of peat or of living moss bogs.

Since there is a rather wide divergence in the degree to which different areas have been drained and subjected to weathering of the surface materials, there is quite a divergence in the soil series or groups within the region. Added to this is a marked diversity of soil textures. From these two facts it becomes possible to distinguish different soil series and divide them into several soil types.

Sassafras series.—The surface soils of the Sassafras series are distinguished by their brownish color and usually rather friable structure. The subsoils are reddish yellow to brownish red in color, friable to compact in structure, and typically rest at some depth on beds of coarse sand and gravel or of fine gravel. Their drainage is excellent. Although of rather small extent in the Norfolk district they constitute soils sought after for truck-crop production. The Sassafras coarse sandy loam, fine sandy loam, and small areas of the loam occur within the district, usually along ridges or near the major drainage ways.

Norfolk series.—The soils of the Norfolk series are gray to yellowish gray in color and usually friable in structure. The subsoil is pale yellow and normally somewhat more compact than the surface soil. At a depth ranging from 5 or 6 inches to 24 or 30 inches there is usually present a rather compact sandy clay subsoil which is decidedly retentive of moisture. Drainage is normally fair to good. This series is the dominant one in the Norfolk trucking district. It is represented by the gravelly sandy loam, gravelly loam, fine sand, coarse sandy loam, fine sandy loam, loam, and silt loam.

Keyport series.—The Keyport series includes soils similar in origin to those of the Norfolk series, but not quite so well drained under natural conditions. The surface soils are grayish brown in color and the subsoils mottled gray and yellow with some reddish-brown stains. The deep subsoil is frequently mottled gray and yellow. It is sometimes water soaked and in most places somewhat plastic. The Keyport fine sandy loam is the only type of this series encountered in the Norfolk area within the trucking district.

Suffolk series.—The surface soils of the Suffolk series are gray or grayish brown in color and rather compact under tillage conditions. The subsoils are pale gray and frequently saturated at a depth varying from 5 inches to 2 feet. They occupy broad, level tracts, away from the principal streams or are found in depressed areas, associated with other soils. Drainage is naturally defective, but can be improved sufficiently for the production of some crops by the use of open ditches. The Suffolk fine sandy loam, loam, and gravelly loam occur in the district.

Portsmouth series.—The types included in the Portsmouth series are characterized by dark-brown to black surface soils and by gray to slightly mottled gray and yellow subsoils. In some places the deeper subsoil is almost white. The surface soils are normally high in organic matter. The Portsmouth soils represent swampy accumulations. The series is poorly drained in its natural condition and occupies depressions, broad level areas, and stream margins. It is the common soil condition of the marginal portions of the Dismal Swamp. Cultivation to quite a variety of crops is possible where drainage has been adequately established.

Swamp.—The Swamp areas of the region consist of the Dismal Swamp and numerous small tracts of undrained land. The soil material consists chiefly of an accumulation of organic matter with varying proportions of mineral matter, the latter having been washed or blown into the swampy areas. The Swamp is largely forested, but considerable tracts of once swampy land have been cleared and drained, both within the limits of the Dismal Swamp and around its margins. In almost all cases such tracts are found to possess soils of the Portsmouth series, although small areas of peat are also encountered.

Dunesand.—Along the coast line, particularly in the vicinity of Cape Henry, there are great accumulations of medium to fine textured wind-blown sand. Part of this material has been heaped up into dunes 15 to 70 feet in elevation, while other large tracts consist of low ridges and intervening hollows or plains of wind-swept sand. Many of these areas are covered with a thick vegetation of live oak and pitch pine; others are bare of vegetation.

Such a wide diversity of drainage and soil conditions naturally gives rise to a considerable difference in the degree to which different localities are utilized for agriculture and to a discriminating occupation of different soil types for use in the intensive business of truck crop production.

DETAILED SOIL AND CROP MAPS.

During the fall of 1915 and the summer of 1916 surveys were made in the vicinity of Churchland and Diamond Springs, Va., to show the relationships that exist between the soils of the Norfolk trucking district and the distribution of the more important crops grown. The Churchland area is fairly representative of the trucking area along the Western Branch of the Elizabeth River, extending thence to the Nansemond River. The Diamond Springs area represents the conditions that exist in the northern part of Princess Anne County, where truck crops are also extensively grown.

The Churchland Area.

A detailed soil and crop map was made in the vicinity of Churchland in the summer of 1916. It covers approximately 1,180 acres of intensively tilled land. The area included lies along the Western Branch of Elizabeth River. It is bounded on the eastern, southern, and western borders by tidewater, while its northern boundary is an arbitrary line. The surface of the upland is nearly level, rising scarcely more than 15 feet above tide level at its greatest elevation. Along the tidewater margins there is usually a steep slope from the general surface down to water level. This narrow border presents practically the only steeply sloping land within the area. Slight depressions and small streamways exist within the upland, but the greater part of the surface is so nearly level that intensive cultivation is carried on over practically every acre.

This area includes the territory within which truck farming has been carried on from the beginning of specialized farming in the Norfolk district and is one of the most intensively cultivated areas in the district.

The detailed soil and crop map of the Churchland area was made on the scale of 6 inches to the mile, or 1 inch to 880 feet.[1] Upon this map the different soils are plotted in great detail and the boundaries of each field or crop area are shown. From this map it is possible to ascertain the actual crop occupation of each soil type at the time of the survey, to measure the total areas of each type occupied by the different crops, and to compute the relative importance of the different soils for the growing of each crop.

In order that both spring and fall conditions might be shown in this region of year-round farming, crop maps were made in June and late in August.

SOILS.

It was found that even within this small area there are seven distinct soil types or conditions, exclusive of tide marsh, the area of which is negligible, and of the sloping areas along the shores, which are not used for any agricultural purpose.

Sassafras fine sandy loam.—The surface soil of the Sassafras fine sandy loam, to a depth of 9 inches, is a friable, brown loamy fine sand. This is underlain to a depth of about 18 inches by a yellow, loamy fine sand, which grades downward into a rather stiff, reddish-brown loam.

The surface of this type is nearly level or only slightly sloping. The type lies adjacent to tidewater and is usually bounded on the outer margins by rather steep slopes. Toward the interior it grades

[1] For publication the several maps have been reduced to a uniform scale of 1 inch to 1,000 feet. These maps will be found at the end of this bulletin.

imperceptibly into the Norfolk fine sandy loam, usually without any appreciable change in level or of slope. It possesses better natural drainage than any other soil in the area and consequently is highly prized for truck crop production. Practically all of it is cleared and used for cropping or for the location of dwellings and grounds.

Norfolk fine sandy loam.—The surface soil of the Norfolk fine sandy loam, to a depth of 9 inches, is a brown to grayish-brown loamy fine sand. This is underlain to a depth of 18 to 20 inches by a yellow fine sand, only slightly coherent. The deeper subsoil, from 20 inches to 36 inches or more, is a yellow to brownish-yellow, stiff sandy loam. The surface of the type is level or but gently sloping, natural drainage conditions are good, and the land is highly esteemed for truck crop production. Owing to its greater extent, not only in this area but in the entire district, it is more important than the Sassafras fine sandy loam for the production of truck crops. Both soils are recognized as excelling any other in the district for this type of farming.

Keyport fine sandy loam.—The surface soil of the Keyport fine sandy loam consists of about 8 inches of grayish-brown fine sandy loam, somewhat coherent and tending to form crusts and clods. The upper 14 inches of the subsoil is a mealy yellow loam to fine sandy loam, and the deeper subsoil a heavy yellow loam, somewhat mottled with gray below a depth of 24 inches.

The surface of this soil is level and somewhat depressed below the adjacent soils. Natural drainage is fairly good but has been supplemented in the Churchland area by extensive systems of tile underdrainage. (Pl. III, fig. 1.)

The Keyport fine sandy loam is chiefly used for the growing of truck crops and is almost completely under tillage for that purpose.

Suffolk fine sandy loam.—The surface soil of the Suffolk fine sandy loam, to a depth of about 9 inches, is a gray to brownish-gray fine sandy loam. It is usually quite coherent and loamy. The subsoil, from 9 to 18 inches, is a pale yellow or gray loam. The deeper subsoil to 36 inches or more is in most places a gray fine sand, slightly loamy and sometimes mottled with yellow iron stains. The material in the lower part is frequently decidedly wet.

The type occupies level to depressed areas in the upland and occurs along some poorly marked streamways. It is poorly drained in its natural condition, but has been generally underdrained and rendered available for truck crop production in the Churchland area. (Pl. III, fig. 2.)

Norfolk fine sand.—The surface soil of the Norfolk fine sand, to a depth of 8 inches, is a yellowish-brown or yellow fine sand, slightly loamy. The subsoil, which extends to a depth of 36 inches or more, without change, is a yellow fine sand.

This soil is of small extent either in the Churchland area or in the general region. It occurs on slight ridges near the shore line and probably represents small accumulations of wind-blown sand. In this locality it is excessively drained.

Loamy sand.—In certain of the tilled fields erosion has carried quantities of fine sand from the higher elevations down the slopes toward the shallow streamways. These slopes are subject to both the accumulation and removal of sandy material from time to time. They present a varied surface soil which is for the most part a yellow fine sand 12 to 20 inches deep. At greater depths this may be loamy or the fine sand may extend to a depth of 36 inches or more.

This material occurs only in narrow bands and usually is cultivated in conjunction with more extensive and important upland types.

Portsmouth loam.—The surface soil of the Portsmouth loam to a depth of 12 inches or more is a dark brown loam. The subsoil is usually a gray, loamy fine sand or a gray fine sand to a depth of more than 36 inches. The type occupies small depressions in the upland and at stream heads. Near the centers of such hollows the brown loamy surface soil sometimes has a depth of 24 inches or even more. The type represents accumulations of organic matter and of soil washed from the uplands. In its natural condition it is poorly drained, but some tracts in the Churchland area have been improved by tile underdraining. The areas are so small that no distinctive cropping is usually adopted.

Steeply sloping land.—Between the upland and the tidewater inlets the land slopes rather steeply down. Such narrow areas have been left in timber to a considerable extent. The slopes are not usually occupied by any definite type of soil, but consist chiefly of somewhat sandy wash from the upland, overlying the more loamy deeper strata of the region.

Tidal marsh.—At the heads of the small tidal indentations there are some small areas of tidal marsh. These have not been drained and are not used agriculturally.

It is notable that practically all of the soils of this area posess a fine sandy loam surface soil. The essential differences between the several types appear most markedly in the subsoils and consist chiefly in differences in the texture and coloration of the deeper subsoil.

The dark-brown to reddish-brown color of the subsoil of the Sassafras fine sandy loam indicates good natural drainage conditions and the thorough aeration and oxidation of the material.

The yellow color of the Norfolk fine sandy loam indicates good drainage and aeration, though possibly not so complete as in the case of the former type.

The gray or mottled coloration of the other types indicates that natural drainage conditions have been more or less imperfect and this has resulted in incomplete aeration and oxidation.

In the Churchland area these variations in natural drainage conditions have been modified in some degree by the installation of tile drains, but the natural conditions of drainage have not become completely changed. (See Pl. III, figs. 1 and 2.)

The distribution of the different soil types in the Churchland area is also significant of the same facts with regard to drainage. The Sassafras and Norfolk fine sandy loams occupy the marginal positions, where drainage is effected directly by seepage to the steeper marginal slopes and by run-off through the deeper streamways. The Keyport and Suffolk fine sandy loams occupy interior positions, where the drainage of water away from the subsoil is not so complete and where the minor streams are not so deeply cut nor effective. The Portsmouth loam is found along streams or at stream heads.

These major facts of drainage illustrate upon a small scale and for limited areas the general conditions throughout the Norfolk district. The best drained lands are generally found nearest the tidewater channels and at the crests of the more elevated ridges. Positions remote from these channels and especially areas which lie on the almost level uplands between the major streamways are less well drained.

USES OF SOILS.

In order that the details of soil occupation might be determined, the completed soil and crop maps of each detailed survey were measured and the acreage of each form of occupation was computed for each soil type.

Since the production of truck crops continues throughout the year in both the Churchland and Diamond Springs areas and since significant methods of cropping are different at different seasons in the Onley area, Eastern Shore district, crop maps were made at two seasons for each of the three Virginia areas.

In the case of the Churchland area the figures shown for the June crop map represent the cropping conditions when the marketing of truck crops is at its height. Some areas of crops, marketed in the early spring, are not shown. The figures given for the August map represent the summer and early fall crop areas of the Churchland area.

Tables II and III show the proportion of total area and of the area of each soil type occupied by the various crops and groups of crops in June and in August, 1916.

TABLE II.—*Proportion of total area and of the area of each soil type occupied by various crops and groups of crops, Churchland area, June, 1916.*

Crop and group of crops.	All soils.		Sassafras fine sandy loam.		Norfolk fine sandy loam.		Keyport fine sandy loam.	
	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.
General farm crops	9.8	0.9	.....	.....	9.2	1.9	0.6	0.3
Soy beans	7.0	.6	.....	.....	6.4	1.3	.6	.3
Corn	2.8	.3	.....	.....	2.8	.6	.....	.....
Truck crops	942.1	87.1	154.7	81.3	438.3	89.8	201.0	95.5
Potatoes	614.5	56.8	91.1	47.9	299.0	61.2	123.4	58.6
Cabbage	142.7	13.3	18.7	9.8	48.8	10.0	48.3	23.0
Beans	52.1	4.8	2.1	1.1	34.4	7.0	7.5	3.6
Cucumbers	15.1	4.8	20.8	10.9	.2	2.4	11.2	7.3
Cucumbers and peas	36.7				11.6		4.1	
Strawberries	45.6	4.6	3.2	3.1	29.9	6.4	5.6	2.6
Strawberries and beans	4.5		2.8		1.3			
Beets	15.6	1.4	10.5	5.5	4.9	1.0	.....	.....
Cauliflower	11.0	1.0	2.8	1.5	7.3	1.5	.9	.4
Miscellaneous vegetables	4.3	.4	2.7	1.5	.9	.2	.....	.....
No annual crops	129.3	12.0	35.5	18.7	40.8	8.3	8.8	4.2
Forest	44.5	4.2	1.6	.8	.8	.2	6.9	3.3
Gardens and grounds	62.8	5.8	27.9	14.7	26.9	5.5	1.9	.9
No crops	20.9	1.9	6.0	3.1	13.1	2.6	.....	.....
Swamp	1.1	.1	.....	.....	.....	.....	.....	.....
Grand total	1,081.2	100.0	190.2	100.0	488.3	100.0	210.4	100.0

Crop and group of crops.	Suffolk fine sandy loam.		Portsmouth loam.		Norfolk fine sand.		Loamy sand.	
	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.
Truck crops	107.5	73.7	9.9	83.9	6.4	68.8	24.3	95.7
Potatoes	71.8	49.2	5.2	44.1	6.4	68.8	17.6	69.3
Cabbage	20.6	14.1	2.4	20.3	.....	.....	3.9	15.3
Beans	6.2	4.3	.4	3.4	.....	.....	1.5	5.9
Cucumbers	3.7	.....	.....	.....	.....	.....	.....	.....
Cucumbers and peas	.2	2.6	.....	.....	.....	.....	.....	.....
Strawberries	5.0	.....	1.9	.....	.....	.....	.....	.....
Strawberries and beans	.....	3.4	.....	16.1	.....	.....	.4	1.6
Beets	.....	.....	.....	.....	.....	.....	.2	.8
Miscellaneous vegetables	.....	.....	.....	.....	.....	.....	.7	2.8
No annual crops	38.3	26.3	1.9	16.1	2.9	31.2	1.1	4.3
Forest	34.4	23.6	.8	6.8	.....	.....	.....	.....
Gardens and grounds	2.8	2.0	.....	.....	2.2	23.7	1.1	4.3
No crops	1.1	.7	.....	.....	.7	7.5	.....	.....
Swamp	.....	.....	1.1	9.3	.....	.....	.....	.....
Grand total	145.8	100.0	11.8	100.0	9.3	100.0	25.4	100.0

Rough, broken land, chiefly in forest, 69.4 acres.
Tidal marsh, 27.3 acres.

TABLE III.—*Proportion of total area and of the area of each soil type occupied by various crops and groups of crops, Churchland area, August, 1916.*

Crop and group of crops.	All soils.		Sassafras fine sandy loam.		Norfolk fine sandy loam.		Keyport fine sandy loam.	
	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.
General farm crops	601.5	55.6	76.6	40.2	270.4	55.1	138.6	66.2
Hay[1]	312.4	28.9	39.1	20.5	153.1	31.2	73.8	35.3
Corn	163.3	15.1	27.3	14.3	71.8	14.6	36.3	17.3
Corn and soy beans	11.7	1.1	.....	.....	1.1	.2	10.4	5.0
Corn and cowpeas	89.0	8.2	8.0	4.2	25.1	5.1	15.1	7.2
Cowpeas	22.7	2.1	2.2	1.2	19.3	3.9	.6	.3
Millet	2.4	.2	.....	.....	.....	.....	2.4	1.1
Truck crops	333.8	30.8	75.7	39.7	170.4	34.7	61.4	29.4
Kale	157.0	14.5	32.7	17.2	84.1	17.1	27.9	13.3
Spinach	70.8	6.5	36.1	18.9	26.0	5.3	7.4	3.6
Potatoes	60.3	5.6	.....	.....	36.5	7.4	17.3	8.3
Strawberries	40.5	3.7	6.5	3.4	22.9	4.7	5.6	2.7
Beans	3.2	.3	.....	.....	.....	.....	3.2	1.5
Sweet potatoes	2.0	.2	.4	.2	.9	.2	.....	.....
No annual crop	146.9	13.5	38.2	20.0	49.9	10.2	9.2	4.4
Forest	44.5	4.1	1.6	.8	.8	.2	6.9	3.3
Gardens and grounds	58.4	5.4	27.9	14.6	22.5	4.6	1.9	.9
No crop	42.9	3.9	8.7	4.6	26.6	5.4	.4	.2
Swamp	1.1	.1	.....	.....	.....	.....	.....	.....
Grand total	1,082.2	99.9	190.5	99.9	490.7	100.0	209.2	100.0

Crop and group of crops.	Suffolk fine sandy loam.		Portsmouth loam.		Norfolk fine sand.		Loamy sand.	
	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.
General farm crops	88.6	60.8	7.9	66.4	4.7	50.5	14.7	59.0
Hay[1]	37.8	26.0	2.1	17.6	.....	.....	6.5	26.1
Corn	17.3	11.8	3.4	28.6	3.7	39.8	3.5	14.1
Corn and soy beans	.....	.....	.....	.....	.....	.....	.2	.8
Corn and cowpeas	33.5	23.0	2.4	20.2	.6	6.4	4.3	17.2
Cowpeas	.....	.....	.....	.....	.4	4.3	.2	.8
Truck crops	15.1	10.4	2.1	17.7	.....	.....	9.1	36.6
Kale	8.4	5.7	.2	1.7	.....	.....	3.7	14.9
Spinach	.7	.5	.....	.....	.....	.....	.6	2.4
Potatoes	2.8	2.0	.....	.....	.....	.....	3.7	14.9
Strawberries	3.2	2.2	1.9	16.0	.....	.....	.4	1.6
Sweet potatoes	.....	.....	.....	.....	.....	.....	.7	2.8
No annual crop	42.0	28.8	1.9	16.0	4.6	49.5	1.1	4.4
Forest	34.4	23.6	.8	6.7	.....	.....	.....	.....
Gardens and grounds	2.8	2.0	.....	.....	2.2	23.7	1.1	4.4
No crop	4.8	3.2	.....	.....	2.4	25.8	.....	.....
Swamp	.....	.....	1.1	9.3	.....	.....	.....	.....
Grand total	145.7	100.0	11.9	100.1	9.3	100.0	24.9	100.0

[1] Volunteer hay, following a spring truck crop.

Rough, broken land, chiefly in forest, 69.4 acres.
Tidal marsh, 27.3 acres.

SOIL AND CROP ACREAGES FOR JUNE.

The crop map for June indicates that a total area of 942.1 acres or 87.1 per cent of the total area mapped is given to the growing of truck crops. In fact only 9.8 acres, or less than 1 per cent of the area, is in general farm crops. The remainder of the area, comprising 129.3 acres of upland, consists of land occupied for gardens and grounds, 62.8 acres; of forest, 44.5 acres; and of land not cropped and land classed as swamp, 22 acres.

The percentages established by this table for "All soils" constitute a standard of comparison for the individual soils. The Sassafras fine sandy loam carries no general farm crops, and is more extensively occupied for home grounds than any other of the types. This arises from its well drained and accessible position near the water fronts and decreases to some extent its showing as a highly prized truck soil.

The Norfolk fine sandy loam carries the only appreciable area of general farm crops, amounting only to 9.2 acres, or less than 2.0 per cent of the total area of the type. It is occupied by 438.3 acres of truck crops, or 89.8 per cent of its area, and has only a small area not occupied by annual crops.

The Keyport fine sandy loam is chiefly occupied by truck crops and is avoided for gardens and grounds. It includes a small but appreciable area of forested land.

The Suffolk fine sandy loam is marked by a high percentage of forested land. The greater part of the forest remaining in the locality is on this type, amounting to 34.4 acres, or 23.6 per cent of its entire area. (See Pl. IV, figs. 1 and 2.) The remainder is used chiefly for truck crop production.

The soils of smaller extent within the area do not show any particularly significant forms of occupation and their area is too small to justify any definite conclusions concerning their specific uses.

It should be emphasized that both the Keyport and the Suffolk fine sandy loam are utilized to a totally disproportionate extent in the Churchland area, because of the fact that the underdrainage of these soils has been decidedly improved by the installation of tile drains, rendering them capable of truck crop production. In the general region they are more commonly used for the growing of forage crops or in the more remote locations have been left in forest.

Of the spring truck crops Irish potatoes occupy the largest area. The Irish Cobbler is grown for the early market and the total acreage amounts to 614.5 acres, or 56.8 per cent of the total upland area. (See Pl. V, figs. 1 and 2.) They constitute over 65 per cent of the total acreage devoted to spring truck crops.

Cabbage constitutes the crop next in rank with regard to acreage. A total of 142.7 acres, or 13.3 per cent of the total area, is given to this crop. The cabbage crop is set during the winter and very early spring and harvested as an early spring crop. (See Pl. VI, fig. 1.)

Beans, either grown alone or interplanted with strawberries, and cucumbers and strawberries are grown to almost an equal extent in this section. The other truck crops are of minor importance.

The distribution of the various spring truck crops on the different soil types shows a slight excess of Irish potatoes on the Norfolk fine

sandy loam and the Keyport fine sandy loam, the former type leading in total acreage and in percentage of acreage for the section. This fact accords well with the general observations with respect to potato production in the Norfolk district. The Norfolk fine sandy loam, both because of its greater extent and of its peculiar suitability of texture and drainage, is the most important Irish potato soil in the district.

With regard to cabbage production, both the Sassafras fine sandy loam and the Norfolk fine sandy loam fall somewhat behind the average for the areas mapped; the area upon the Keyport fine sandy loam is decidedly larger than the general average, and that upon the Suffolk fine sandy loam is somewhat above the general average.

The proportionate area in snap beans is higher on the Norfolk fine sandy loam than on any other type.

Cucumbers are somewhat concentrated upon the Sassafras and Keyport fine sandy loams, the former leading.

Strawberries are chiefly encountered on the Norfolk fine sandy loam, while garden peas are grown chiefly as an interplanted crop with cucumbers on the Sassafras fine sandy loam.

SOIL AND CROP ACREAGES FOR AUGUST.

The soil and crop map showing conditions in the latter part of August indicates a totally different distribution of cropping from that recording conditions in June. In August the spring truck crops have been harvested and marketed and their places taken either by forage crops or by truck crops capable of making a full growth and of being harvested during the winter months.

The general farm crops cover, in August, 601.5 acres, or 55.6 per cent of the total upland area. The truck crops, including strawberries, which occupy the land during the year, covered but 333.8 acres, or 30.8 per cent of the area. The area not occupied by annual crops is slightly greater than in June, owing to the fact that certain fields have not been replanted.

The standards for the area are again established by the percentages for "All soils." It appears that the soils which do not possess the most complete natural drainage bear a somewhat high proportion of forage crops, as in the case of the Keyport and Suffolk fine sandy loams, which carry, respectively, 66.2 and 60.8 per cent of general farm crops, while the Sassafras and Norfolk fine sandy loams carry but 40.2 and 55.1 per cent of their areas in such crops. The latter figure is approximately the normal for the area, as would be expected from the dominating extent of the type.

Among the fall and winter truck crops the largest acreage is given to kale in the Churchland area. It occupies a total area of 157 acres or nearly one-half of the total in truck crops. The Sassafras and

S-8356

FIG. 1.—INTERPLANTING OF POTATOES AND STRAWBERRIES ON NORFOLK COARSE SANDY LOAM, DIAMOND SPRINGS, VA.

S-8244

FIG. 2.—INTERPLANTING OF SNAPBEANS AND STRAWBERRIES ON NORFOLK FINE SANDY LOAM, NEAR CHURCHLAND, VA.

S-8256

FIG. 1.—TRUCK CROPS TAKEN BY POWER BOAT TO THE SHIPPING POINT AT NORFOLK. WESTERN BRANCH.

S-8222

FIG. 2.—POTATOES, SHIPPED BY RAIL AT LOCAL STATIONS, NEAR CHURCHLAND, VA.

S-8458

FIG. 1.—INTAKES FOR TILE DRAINAGE ON KEYPORT FINE SANDY LOAM, CHURCHLAND AREA, VA.

S-8486

FIG. 2.—TILE DRAINAGE ON KEYPORT AND SUFFOLK FINE SANDY LOAMS, NEAR CHURCHLAND, VA.

S-8514

FIG. 1.—PINE FOREST ON SUFFOLK FINE SANDY LOAM, NEAR CHURCHLAND, VA.

S-8423

FIG. 2.—CUT-OVER TIMBER ON NORFOLK LOAM, NEAR DIAMOND SPRINGS, VA.

S-8516

FIG. 1.—EARLY POTATOES, IRISH COBBLER, ON NORFOLK FINE SANDY LOAM, NEAR CHURCHLAND, VA.

S-8261

FIG. 2.—HARVESTING EARLY POTATOES IN THE NORFOLK TRUCKING DISTRICT.

Norfolk fine sandy loams are the chosen soils for this crop, although the Keyport fine sandy loam is likewise important in its production.

Spinach is second in acreage to kale, covering 70.8 acres, or 6.5 per cent of the total upland area. Its production is decidedly localized upon the Sassafras fine sandy loam, the best drained soil in the area. Only the Norfolk fine sandy loam bears any large additional acreage.

The fall crop of Irish potatoes, the "Peachblow" variety, occupies 60.3 acres, or 5.6 per cent of the area. This fall crop is chiefly upon the Norfolk and Keyport fine sandy loams.

The acreage in strawberries is slightly less than in June because of the plowing out of old beds. The fall acreage is found chiefly upon the Norfolk and Keyport fine sandy loams.

Only a small extent of other fall crops is shown in this map.

One of the characteristics of the cropping system of the district is brought out clearly in the tabulation of the general farm crops for August. The area in hay amounts to 312.4 acres, or 28.9 per cent of the entire area. Corn, either planted alone or interplanted with cowpeas and soy beans, occupies 265 acres, or 24.4 per cent of the total. Cowpeas and millet comprise the other crops of this class.

It is the common practice in this intensively farmed region to plant as large an area as possible to the spring and early summer truck crops. As fast as these crops are harvested and the ground can be prepared, it is planted to a summer forage crop, usually corn. In order that some leguminous crop may be grown at some perod in the rotation, it is coming to be the practice to interplant either cowpeas or soy beans in the corn, or to drill or sow cowpeas broadcast upon the land. (See Pl. VI, fig. 2.) By this method a supply of forage for the work stock is produced at a period in the year when the land would not be occupied by cash crops, and many of the truckers utilize this time to grow a legume crop either for green manure or forage.

The large area in hay arises from the fact that it is almost entirely volunteer grasses, chiefly crab grass (Pl. VII, fig. 1), which spring up spontaneously upon the areas from which the spring truck crops have been harvested. This grass is allowed to come to maturity and a considerable acreage is cut for hay annually.

After these different forage crops have been harvested the land is ready for late fall or winter plowing and is used either for a winter cabbage crop or for the potato area of the next spring. This system permits the production of some forage, the growing of a green manuring crop, when desired, and the utilization of the residual effects of manures and fertilizers which have been applied to the preceding spring truck crop.

This rapid succession of crops, the interplanting of such crops as peas and beans with strawberries and cucumbers, and the year-round utilization of the land are characteristic features of the Churchland area and of the general district.

The completion of land drainage through the use of tile is probably more general in the immediate vicinity of Churchland than in other parts of the Norfolk district, but is not confined to that locality.

Another feature of the Churchland area is the common use of natural forest areas or of planted windbreaks to protect the winter and early spring crops from cold winds. The tilled areas are very commonly protected in this manner and in some cases individual fields of small area are surrounded by hedges. Such a windbreak is shown in Plate VII, figure 2.

In this area, in which the trucking industry of the district had its inception, every device for promoting the early and uninterrupted growth of crops is employed. Not only are the well-drained, somewhat sandy soils utilized as in other districts, but soils not naturally so well suited to trucking have been improved by drainage until they are available for the growing of the more important crops, such as cabbage and potatoes, and the climatic conditions above the soil have been improved by windbreaks.

The Diamond Springs Area.

During the fall of 1915 and the spring of 1916, a soil and crop map of an area of approximately 1,909 acres was made in the vicinity of Diamond Springs, Va. The territory included in this survey lies along the Cape Henry Division of the Norfolk Southern Railroad, in the northwestern part of Princess Anne County and about 7½ miles northeast of Norfolk. The southern boundary of the area is an arbitrary line, but the greater part of the eastern, northern, and northwestern boundaries is formed by the waters of Lakes Lawson and Smith and by Little Creek.

The surface of the area mapped falls into two rather distinct topographic divisions. The northern two-fifths of the area consists of a low plain whose maximum elevation of about 15 feet above tide level is attained at its southern boundary. It slopes very gently to the north, descending rather sharply to the water boundaries of the area. It consists of a series of low peninsulas, separated by narrow arms of the artificial bodies of water which surround the area on this side. The general surface is nearly level, although low ridges not more than 5 feet higher than the general surface may be detected. The surface of the plain ranges from about 8 feet to 15 feet above tide-water level. There are few stream channels within this plain except those which indent its margin.

Along the southern boundary of this plain the land rises gently to an elevation of 25 to 30 feet along the crest of a low ridge, extending in an east and west direction across the area. The surface of this ridge is somewhat uneven, being marked by slight depressions without outlets. Its crest is near its northern border whence it slopes gently toward the south and southeast. The elevations along the southern border of the area mapped range from about 15 to 20 feet above tide level.

The distribution of the soils of the area is closely related to the topographic features. The lower plain is chiefly occupied by the Norfolk loam and the Sassafras fine sandy loam. The higher portion of the ridge is occupied by the Sassafras and the Norfolk coarse sandy loam, with small isolated areas of the Norfolk loam in the depressions. The gentle southern slope of the ridge is occupied by the Sassafras loam and the Norfolk loam and gravelly loam; the lower land along the southern border of the area consists of areas of the Suffolk loam and gravelly loam. Certain of the steeper slopes around the border of the area consist of discontinuous areas of the Norfolk gravelly sandy loam.

There are few slopes within the area so steep as to interfere with cultivation. Drainage is somewhat defective in the southern part of the area, but is well established over the surface of the low ridge and fairly well established in the lower plain to the north.

Truck-crop production has been conducted within the section for a considerable period of time, and the Virginia Truck Experiment Station is situated within the limits of the area mapped. The Diamond Springs area represents the soil conditions which prevail over a considerable proportion of Princess Anne County, particularly in the northern part along Chesapeake Bay.

SOILS.

Ten different types of soil are mapped in the Diamond Springs area, exclusive of small areas of Swamp.

Sassafras coarse sandy loam.—The surface soil of the Sassafras coarse sandy loam, to an average depth of about 6 inches, is a grayish-brown medium to coarse sandy loam carrying small quantities of fine gravel. From 6 inches to 14 or 18 inches in depth the subsoil is a yellow to golden-yellow coarse sandy loam. This is underlain to a depth of about 36 inches by a crumbly but decidedly coherent sandy loam, containing a large proportion of coarse sand mixed with silt and clay. In many places the material changes below 36 inches to a coarse loamy sand of an orange color. Fine gravel is found at all depths.

This type occupies the highest elevations within the area. It is naturally well drained and somewhat porous. The more coherent deep subsoil, however, prevents extreme droughtiness.

A large part of the Sassafras coarse sandy loam has been cleared, and is used for the production of both spring and winter truck crops.

Sassafras fine sandy loam.—The surface soil of the Sassafras fine sandy loam consists of 5 to 8 inches of brown fine sandy loam. The upper subsoil, to a depth of about 16 inches, is a reddish-yellow to orange fine sandy loam. Below 16 inches the subsoil is a rather heavy reddish-brown fine sandy loam or light loam. In some cases a bed of orange sand and fine gravel is encountered at 34 to 36 inches below the surface.

The Sassafras fine sandy loam occupies the higher elevations on the low ridges or swells occurring in the lower plain. It is also found along the margins of the deeper drainage ways. In all positions its natural drainage is good.

The type differs slightly from the occurrences in the Churchland area. Both soil and subsoil contain rather more medium and coarse sand and less fine sand, while there is also a larger amount of silt in the deeper subsoil. The type is possibly slightly more retentive of moisture in the Diamond Springs area than in the Churchland area. It is used for the growing of both forage and truck crops in the Diamond Springs area.

Sassafras loam.—The surface soil of the Sassafras loam is a brown, friable loam, 6 inches or more deep, containing in many places some fine gravel and coarse sand. From 6 to 36 inches or more the subsoil is a reddish-brown loam, distinctly compact and heavy.

The Sassafras loam is found on nearly level upland areas adjacent to the deeper-cut drainage ways. Drainage is excellent and the type is cleared and occupied by truck crops nearly to the limit of its extent.

Norfolk coarse sandy loam.—The surface soil of the Norfolk coarse sandy loam, to a depth of 5 inches, is a yellowish-brown coarse sandy loam. A varying amount of fine gravel is found throughout the surface soil. From 5 to 16 or 18 inches in depth the subsoil is a yellow coarse sandy loam. This is underlain to a depth of 36 inches or more by a rather heavy, yellow sandy loam.

The Norfolk coarse sandy loam occurs along the crest of the low ridge extending through the center of the area, in close association with the Sassafras coarse sandy loam. The surface is only gently sloping. Drainage is good to rather excessive. The greater part of the type is cleared and under cultivation.

Norfolk loam.—The surface soil of the Norfolk loam, to a depth of 4 or 5 inches, is a grayish-brown loam, containing enough very fine sand to render it soft and friable. The subsoil, to a depth of 32 inches or more, is a yellow loam sufficiently high in silt and clay to

make it compact and stiff. In some cases compaction amounts almost to a "hardpan" condition. The deeper subsoil in places is a pale yellow coarse sandy loam.

The larger areas of the Norfolk loam lie in the lower plain where the surface is nearly level. In such locations drainage is not completely established and the deeper subsoil is frequently found to be saturated. The areas of greatest extent at the higher levels are fairly well drained under natural conditions, but can be improved by the installation of tile. Some small areas, not typical, occur in the slight depressions of the higher plain. These possess no natural outlet for drainage and the deep subsoil is inclined to be wet.

A part of this type has been cleared and used for the production of both forage and truck crops. By far the larger part, including large areas in the lower plain, are uncleared or partly overgrown with second-growth (see Pl. IV, fig. 2) oak and pine. The type is not highly esteemed for truck-crop production, but may be so used if underdrainage is installed, as has been shown upon the grounds of the Virginia Truck Experiment Station.

Norfolk silt loam.—The surface soil of the Norfolk silt loam consists of 10 or 12 inches of yellowish-brown silt loam. The subsoil, to 36 inches or more in depth, is a stiff, compact, pale-yellow silt loam. The type is developed only in one small, depressed area upon the Experiment Station Farm and probably represents an accumulation of fine material washed in from the surrounding area of Norfolk loam. So far as is known this soil does not occur extensively within the general region.

Norfolk gravelly loam.—To a depth of 5 or 6 inches the surface soil of the Norfolk gravelly loam is a gray to yellowish-brown, gravelly sandy loam. The fine gravel and coarse sand are decidedly apparent, but there is enough fine-grained material present to cause the surface to clod and bake after rains. The subsoil, from 5 to 16 inches in depth, is a coarse-grained gravelly sandy loam. From 16 to 36 inches or more the deep subsoil is a sticky, yellow gravelly loam. This deep subsoil is frequently compacted and mortarlike.

The surface of the type is nearly level to slightly sloping. The natural drainage conditions are only fair or, over some areas, decidedly defective. A considerable part of this soil remains in forest and the remainder is farmed with a variety of truck and market garden crops. The settlement of colored farmers near Burton is partly located on this soil.

Norfolk gravelly sandy loam.—The surface soil of the Norfolk gravelly sandy loam is a gray to yellow coarse sandy loam, 6 or 8 inches deep. A large amount of fine gravel is usually present. The subsoil is a coarse, loamy yellow sand. It is usually underlain by a heavier yellow sandy loam.

This soil occurs chiefly on the steeper slopes from the upland to water level and around the stream heads. It consists largely of coarse sandy wash from upland types. Drainage is excessive and the material is subject to additions and removals of soil material due to erosion. It is chiefly forested, although small areas extend into tilled fields.

Suffolk gravelly loam.—The surface soil of the Suffolk gravelly loam is a grayish-brown gravelly loam, with a depth of 8 inches. This is underlain by a pale-gray gravelly loam to 36 inches or more. The deeper subsoil is usually saturated.

The type occurs in level or depressed areas where natural drainage is poor. A large part is in forest and the remainder is farmed to various crops, chiefly by colored farmers.

Suffolk loam.—The Suffolk loam consists of 4 or 5 inches of dark gray loam, underlain by a subsoil of gray silty loam, which extends to a depth of 36 inches. A small amount of fine gravel is found in the soil and subsoil. The deeper subsoil is usually saturated. The type occupies depressed areas and is poorly drained. It is chiefly in forest.

Swamp.—A few small areas of Swamp occur around the margin of the Diamond Springs area. These lie at water level and are not easily drained.

It is apparent that a considerable diversity of soil texture and of natural conditions of drainage exists within the Diamond Springs area. The three soils of the Sassafras series and the Norfolk coarse sandy loam are well drained. The Norfolk silt loam, loam, and gravelly loam are but moderately drained. The Suffolk loam and gravelly loam are poorly drained. These facts become evident in the crop uses of the different soil types.

USES OF SOILS.

The completed soil and crop maps for November, 1915, and for June, 1916, were measured in order to show the relative and absolute uses of each soil for the production of the different crops and groups of crops. The areas given for November represent the fall and winter conditions; those for June represent the spring and early summer crop areas. Some areas of crops which had been marketed in the early spring are not shown.

Tables IV and V give the statistics in detail, the former showing conditions in June and the latter in November.

TABLE IV.—*Proportion of total area and of the area of each soil type occupied by various crops and groups of crops, Diamond Springs area, June, 1916.*

Crop and group of crops.	All soils.		Sassafras coarse sandy loam.		Sassafras fine sandy loam.		Sassafras loam.		Norfolk coarse sandy loam.		Norfolk loam.	
	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.
General farm crops	240.4	12.6	29.1	10.5	41.8	27.1	2.5	2.4	13.5	4.6	57.4	11.6
Hay and pasture	14.8	.8	2.7	1.0	2.2	1.4	.....	.....	2.6	.9	4.0	.8
Corn	193.2	10.1	26.4	9.5	30.3	19.7	.....	.....	10.9	3.7	44.0	8.9
Wheat	15.1	.8	.....	.....	9.3	6.0	.....	.....	.....	.....	5.8	1.2
Oats	9.3	.5	.....	.....	.....	.....	.....	.....	.....	.....	3.6	.7
Cowpeas	8.0	.4	.....	.....	.....	.....	2.5	2.4	.....	.....	.....	.....
Truck crops	674.7	35.5	152.6	54.8	23.5	15.2	69.3	67.3	198.8	68.3	67.2	13.6
Strawberries	248.3		83.7		.2		20.2		70.2		40.4	
Strawberries and potatoes	21.1	15.1	16.4	36.1	.....	.1	.....	23.7	.5	27.6	.7	8.3
Strawberries and beans	16.8		.2		.....		4.2		9.3		.....	
Cabbage	118.1	6.2	16.9	6.0	.2	.1	22.7	22.0	50.6	17.4	14.0	2.8
Potatoes	111.1	5.8	12.7	4.5	6.0	3.9	4.8	4.7	63.2	21.7	6.0	1.2
Beans	71.7	3.8	10.0	3.6	10.2	6.6	3.6	3.5	1.5	.5	1.7	.4
Sweet potatoes	28.8	1.5	8.0	2.9	.....	.....	5.5	5.3	1.8	.6	1.5	.3
Cucumbers	18.4	1.0	.....	.....	6.9	4.5	.5	.5	.4	.1	.4	.1
Tomatoes	10.2	.5	.....	.....	.....	.....	.2	.2	.....	.....	.....	.....
Cantaloupe	9.1	.5	.....	.....	.....	.....	7.6	7.4	.....	.....	.....	.....
Radish	8.0	.4	4.7	1.7	.....	.....	.....	.....	1.3	.4	1.5	.3
Pumpkin and squash	7.7	.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Miscellaneous truck crop	5.4	.3	.....	.....	.....	.....	.....	.....	.....	.....	1.0	.2
No annual crop	985.7	51.9	96.5	34.7	88.7	57.6	31.1	30.2	78.8	27.1	370.8	74.9
Forest	573.4	30.2	58.2	21.0	44.0	28.6	11.8	11.5	56.4	19.4	200.3	40.4
No crops	329.4	17.3	21.8	7.8	36.7	23.8	16.7	16.2	10.2	3.5	165.6	33.5
Garden and grounds	55.3	2.9	12.7	4.6	7.3	4.7	2.6	2.5	6.5	2.2	3.1	.6
Orchard and vineyard	27.6	1.5	3.8	1.3	.7	.5	.....	.....	5.7	2.0	1.8	.4
Grand total	1,900.8	100.0	278.2	100.0	154.0	99.9	102.9	99.9	291.1	100.0	495.4	100.1

Crop and group of crops.	Norfolk gravelly loam.		Suffolk gravelly loam.		Suffolk loam.		Norfolk gravelly sandy loam.		Norfolk silt loam.		Swamp.	
	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.
General farm crops	38.7	14.6	12.8	17.6	43.2	22.1	1.4	4.1	.....	.....	.....	.....
Hay and pasture	.....	.....	.4	.5	1.5	.8	1.4	4.1	.....	.....	.....	.....
Corn	32.8	12.4	9.1	12.6	39.7	20.3	.....	.....	.....	.....	.....	.....
Wheat	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Oats	2.6	1.0	2.9	4.0	.2	.1	.....	.....	.....	.....	.....	.....
Cowpeas	3.3	1.2	.4	.5	1.8	.9	.....	.....	.....	.....	.....	.....
Truck crops	95.2	36.1	30.1	41.7	34.1	17.4	3.9	11.2	.....	.....	.....	.....
Strawberries	15.7		4.4		13.5							
Strawberries and potatoes	.....	6.8	.....	6.1	.....	7.3	3.5	10.0	.....	.....	.....	.....
Strawberries and beans	2.4		.....		.7							
Cabbage	6.6	2.5	3.1	4.3	3.8	2.0	.2	.6	.....	.....	.....	.....
Potatoes	14.2	5.4	3.1	4.3	.9	.4	.2	.6	.....	.....	.....	.....
Beans	25.1	9.5	8.7	12.0	10.9	5.6	.....	.....	.....	.....	.....	.....
Sweet potatoes	6.9	2.6	3.5	4.8	1.6	.8	.....	.....	.....	.....	.....	.....
Cucumbers	5.1	1.9	4.4	6.1	.7	.3	.....	.....	.....	.....	.....	.....
Tomatoes	9.3	3.5	.7	1.0	.....	.....	.....	.....	.....	.....	.....	.....
Cantaloupe	1.5	.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Radish	.5	.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pumpkin and squash	5.5	2.1	1.5	2.1	.7	.3	.....	.....	.....	.....	.....	.....
Miscellaneous truck	2.4	.9	.7	1.0	1.3	.7	.....	.....	.....	.....	.....	.....
No annual crop	130.1	49.3	29.3	40.7	117.6	60.3	29.3	84.7	9.0	100.0	4.5	100.0
Forest	65.1	24.7	14.2	19.7	97.9	50.2	25.5	73.7	.....	.....	.....	.....
No crops	41.9	15.9	8.0	11.1	13.2	6.8	1.8	5.2	9.0	100.0	4.5	100.0
Garden and grounds	13.8	5.2	3.1	4.3	5.8	3.0	.4	1.1	.....	.....	.....	.....
Orchard and vineyard	9.3	3.5	4.0	5.6	.7	.3	1.6	4.7	.....	.....	.....	.....
Grand total	264.0	100.0	72.2	100.0	194.9	99.8	34.6	100.0	9.0	100.0	4.5	100.0

TABLE V.—*Proportion of total area and of the area of each soil type occupied by various crops and groups of crops, Diamond Springs area, November, 1915.*

Crop and group of crops.	All soils.		Sassafras coarse sandy loam.		Sassafras fine sandy loam.		Sassafras loam.		Norfolk coarse sandy loam.		Norfolk loam.	
	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.
General farm crops	289.0	15.1	35.0	12.6	16.9	10.9	2.5	2.4	38.5	13.1	87.1	17.5
Hay and pasture	23.3	1.2	2.2	.8	2.7	1.7	.....	.....	2.2.	.7	4.3	.9
Corn	188.5	9.9	9.4	3.4	14.2	9.2	.9	.9	29.9	10.2	60.3	12.1
Corn and cowpeas	36.7	1.9	15.5	5.6	.....	.....	.....	.....	2.3	.8	9.2	1.8
Soy beans	19.6	1.0	7.9	2.8	.....	.....	1.6	1.5	4.1	1.4	6.0	1.2
Oats	8.4	.4	.....	.....	.....	.....	.....	.....	.....	.....	.5	.1
Sorghum	6.8	.4	.....	.....	.....	.....	.....	.....	.....	.....	6.8	1.4
Cowpeas	5.7	.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Truck crops	632.9	33.2	155.4	55.7	49.5	32.0	67.5	66.1	165.8	56.6	61.7	12.3
Spinach	257.5	13.5	65.7	23.5	40.5	26.2	54.7	53.5	48.8	16.6	27.9	5.6
Strawberries	132.1	11.0	41.2	27.5	.....	.....	9.2	10.6	34.2	21.2	12.8	4.8
Strawberries and beans	74.5		34.0		.....	.....	1.6		25.2		11.0	
Strawberries and peas	4.3		1.4		.....	.....	.....		2.7		.2	
Cabbage	36.9	2.0	.7	.3	.....	.....	1.3	1.3	19.2	6.6	2.2	.4
Kale	31.2	1.6	4.0	1.4	4.0	2.6	.....	.....	14.4	4.9	3.6	.7
Potatoes	28.5	1.5	.....	.....	5.0	3.2	.7	.7	19.2	6.6	.9	.2
Beans	25.1	1.3	4.0	1.4	.....	.....	.....	.....	1.4	.5	2.2	.4
Turnips	20.7	1.1	.4	.1	.....	.....	.....	.....	.....	.....	.....	.....
Sweet potatoes	10.0	.5	2.7	1.0	.....	.....	.....	.....	.....	.....	.4	.1
Tomatoes	5.0	.3	.....	.....	.....	.....	.....	.....	.7	.2	.5	.1
Misc. truck crops	7.1	.4	1.3	.5	.....	.....	.....	.....	.....	.....	.....	.....
No annual crop	981.5	51.6	88.5	31.7	88.2	57.0	32.2	31.5	88.7	30.3	348.2	70.0
Forest	601.7	31.6	64.3	23.0	44.0	28.5	12.9	12.6	68.8	23.5	205.6	41.3
No crop	322.0	16.9	14.8	5.3	36.2	23.4	18.7	18.3	11.7	4.0	137.9	27.7
Garden and grounds	36.9	2.0	5.8	2.1	7.3	4.7	.6	.6	2.4	.8	2.9	.6
Orchard and vineyard	20.9	1.1	3.6	1.3	.7	.4	.....	.....	5.8	2.0	1.8	.4
Grand total	1,903.4	99.9	278.9	100.0	154.6	99.9	102.2	100.0	293.0	100.0	497.0	99.8

Crop and group of crops.	Norfolk gravelly loam.		Suffolk gravelly loam.		Suffolk loam.		Norfolk gravelly sandy loam.		Norfolk silt loam.		Swamp.	
	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.
General farm crops	54.8	20.7	23.0	32.2	27.6	14.3	3.6	10.4	.....	.....	.....	.....
Hay and pasture	1.4	.5	.....	.....	7.4	3.8	3.1	9.0	.....	.....	.....	.....
Corn	38.7	14.6	15.3	21.4	19.3	10.0	.5	1.4	.....	.....	.....	.....
Corn and cowpeas	6.8	2.6	2.9	4.1	.....	.....	.....	.....	.....	.....	.....	.....
Soy beans	4.7	1.8	3.2	4.5	.....	.....	.....	.....	.....	.....	.....	.....
Sorghum	3.2	1.2	1.6	2.2	.9	.5	.....	.....	.....	.....	.....	.....
Truck crops	73.5	27.7	17.2	23.9	39.6	20.4	2.7	7.8	.....	.....	.....	.....
Spinach	13.0	5.0	2.0	2.8	2.2	1.1	2.7	7.8	.....	.....	.....	.....
Strawberries	16.2	6.1	4.1	5.7	14.4	8.8	.....	.....	.....	.....	.....	.....
Strawberries and beans	.....		.....		2.7		.....	.....	.....	.....	.....	.....
Strawberries and peas	.....		.....		.....		.....	.....	.....	.....	.....	.....
Cabbage	6.1	2.3	1.6	2.2	5.8	3.0	.....	.....	.....	.....	.....	.....
Kale	4.0	1.5	.7	1.0	.5	.3	.....	.....	.....	.....	.....	.....
Potatoes	1.8	.7	.....	.....	.9	.5	.....	.....	.....	.....	.....	.....
Beans	12.1	4.5	1.8	2.5	3.6	1.8	.....	.....	.....	.....	.....	.....
Turnips	9.4	3.5	4.1	5.7	6.8	3.5	.....	.....	.....	.....	.....	.....
Sweet potatoes	3.8	1.5	1.3	1.8	1.8	.9	.....	.....	.....	.....	.....	.....
Tomatoes	2.2	.8	1.1	1.5	.5	.3	.....	.....	.....	.....	.....	.....
Misc. truck crops	4.9	1.8	.5	.7	.4	.2	.....	.....	.....	.....	.....	.....
No annual crop	136.4	51.5	31.3	43.8	126.2	65.3	28.3	81.8	9.0	100.0	4.5	100.0
Forest	67.5	25.5	14.2	19.7	97.9	50.7	26.5	76.6	.....	.....	.....	.....
No crop	57.1	21.6	10.3	14.4	21.8	11.3	.....	.....	9.0	100.0	4.5	100.0
Garden and grounds	8.6	3.2	3.1	4.5	5.8	3.0	.4	1.2	.....	.....	.....	.....
Orchard and vineyard	3.2	1.2	3.7	5.2	.7	.3	1.4	4.0	.....	.....	.....	.....
Grand total	264.7	99.9	71.5	99.9	193.4	100.0	34.6	100.0	9.0	100.0	4.5	100.0

SOIL AND CROP ACREAGES FOR JUNE.

The measurements for June show that 674.7 acres of land, or 35.5 per cent of the total area, are occupied by truck crops. The general farm crops occupy 240.4 acres, or 12.6 per cent of the area. No annual

crops are grown upon 985.7 acres, or 51.9 per cent of the area mapped. Forest occupies 573.4 acres, or 30.2 per cent of all the land area, and an additional area of 329.4 acres of land is not in commercial crops.

The figures given for "All soils" establish a standard of crop occupations for the area and it is possible to make comparison of the relative areas of the different crops and groups of crops for each soil type with this standard.

The Norfolk coarse sandy loam, Sassafras coarse sandy loam, and Sassafras loam all carry a high percentage of truck crops.

The Sassafras fine sandy loam, the Norfolk gravelly loam, and the Suffolk loam and gravelly loam all carry a percentage of the general farm crops above the average.

The Norfolk loam, Suffolk loam, and Norfolk gravelly sandy loam carry a high percentage of forested area.

Strawberries, either grown alone or interplanted with potatoes or beans, occupy 286.2 acres. This is a larger area than in any other spring truck crop and amounts to 15 per cent of the total area mapped. (See Pl. VIII, figs. 1 and 2.)

Cabbage ranks second among truck crops, covering 118.1 acres or 6.2 per cent of the area.

Irish Cobbler potatoes cover 111.1 acres and are interplanted with strawberries to an additional extent of 21.1 acres.

Snap and lima beans occupy 71.7 acres, to which should be added an area of 16.8 acres, interplanted with strawberries. (See Pl. IX, figs. 1 and 2.)

The remaining truck crops occupy subordinate acreages, with sweet potatoes, cucumbers, tomatoes, and cantaloupes as the leading crops.

Among the general farm crops corn is by far the most important, occupying 192.3 acres, or 10.1 per cent of the total area mapped.

The large area not occupied by any crop is caused by the fact that a considerable part of the Norfolk loam and a part of the Sassafras fine sandy loam, both occurring in the lower plain, are included in a tract not regularly farmed. The crop areas of the Virginia Truck Experiment Station farm [2] are not measured and included in

[2] The following table gives the area of the several soils in this tract:

Soils of the Virginia Truck Experiment Station farm.

Soil type.	In forest.	Experimental plots and station grounds.	Total area.
	Acres.	*Acres.*	*Acres.*
Sassafras coarse sandy loam	0.7	6.7	7.4
Sassafras loam		3.8	3.8
Norfolk coarse sandy loam	4.7	3.4	8.1
Norfolk gravelly sandy loam		1.4	1.4
Norfolk gravelly loam		10.3	10.3
Norfolk silt loam		9.0	9.0
Norfolk loam	3.6	20.3	23.9
	9.0	54.9	63.9

the crop tabulation since they are handled chiefly for experimental purposes. At the time of the survey potatoes occupied the greater part of this acreage, while cabbage, strawberries, and cucumbers with some forage crops and orchard occupied the remainder.

The distribution of the various spring crops upon the different soil types shows a selection of the Sassafras coarse sandy loam and the Norfolk coarse sandy loam for the growing of strawberries. These well-drained soils are capable of maturing an early crop, which is desired in order to obtain the higher prices. The Sassafras loam also is extensively planted to strawberries.

The same group of soils leads in cabbage area. The largest number of acres is found on the Norfolk coarse sandy loam, while the highest percentage of total acreage in cabbage is found on the Sassafras loam. Approximately one-half of the total area of Irish potatoes is found on the Norfolk coarse sandy loam, and this type appears to be distinctly preferred for the crop, 21.7 per cent of its area being thus occupied.

Of the beans, snap beans appear chiefly upon the Sassafras coarse sandy loam and fine sandy loam and pole lima beans upon the Norfolk gravelly loam and the Suffolk loam and gravelly loam. The latter crop is very extensively grown by the colored farmers in the vicinity of Burton, which accounts largely for the use of these soils for bean growing.

The distribution of the other truck crops is not especially significant.

SOIL AND CROP ACREAGES FOR NOVEMBER.

The November, 1915, crop map shows about the same proportionate distribution of area between general farm crops and truck crops as is shown by the map for June, 1916. The forage crops occupy 289 acres, or 15.1 per cent of the entire area. The truck crops cover 632.9 acres, or almost exactly one-third of the total area mapped.

Among the general farm crops, corn leads in acreage. It covers 188.5 acres, planted alone, and an additional area of 36.7 acres in combination with cowpeas. It thus occupies 11.8 per cent of the whole area.

Hay and pasture, soy beans, and subordinate forage crops occupy 63.8 acres, or 3.3 per cent of the area.

Spinach is the winter truck crop most extensively grown in this locality, occupying 275.5 acres, or 13.5 per cent of the total area. (See Pl. X, fig. 1.)

Strawberries, either planted alone or with a fall crop of peas or snap beans, occupy 210.9 acres, or 11 per cent of the area.

Beans, interplanted with strawberries, occupy 74.5 acres, while beans planted alone, chiefly pole limas, occupy an additional area of 25.1 acres.

Cabbage, covering 36.9 acres, kale to the extent of 31.2 acres, and fall potatoes, covering 28.5 acres, are the other important fall and winter truck crops.

The area in forest is higher than on the June map, as some forested land was cleared and placed under cultivation in the winter of 1915–16. The area of cleared land not cropped is high from the fact that a considerable tract was not being farmed.

The restrictions of winter truck crops to certain soil types is rather marked. The Sassafras and Norfolk coarse sandy loams occupy only 30 per cent of the total area mapped, but they carry more than 50 per cent of the total acreage of truck crops. The Sassafras fine sandy loam and loam are also important truck crop soils. The Norfolk loam, Norfolk gravelly loam, the Suffolk gravelly loam, and Suffolk loam cover nearly 51 per cent of the area but support only 30.3 per cent of the truck crop acreage.

It is evident that only the best drained soils of the locality are utilized for growing the crops which occupy the land during the winter or throughout the year.

With reference to individual truck crops, it appears that spinach is grown chiefly on the Sassafras loam, which carries 54.7 acres, or 53.5 per cent of its area, in the crop; on the Sassafras fine sandy loam, bearing 40.5 acres, or 26.2 per cent of its area in spinach; and on the Sassafras coarse sandy loam, which carries 65.7 acres, or 23.5 per cent of its area in that crop. As the Norfolk coarse sandy loam bears 48.8 acres of spinach, or 16.6 per cent of its area, nearly 80 per cent of the entire acreage of spinach is found on these 4 types of soil.

Nearly two-thirds of the acreage in strawberries occurs on the Sassafras and Norfolk coarse sandy loams. This is fairly comparable with the spring conditions, since the crop continues on the ground throughout the year.

The largest acreage in cabbage is on the Norfolk coarse sandy loam, 19.2 acres, or 6.6 per cent of the area of the type. This is a little more than one-half of the total fall planting of cabbage. The greater part of the remaining acreage in cabbage occurs on the Norfolk gravelly loam and the Suffolk loam.

The Norfolk coarse sandy loam carries nearly one-half of the total area of kale.

More than two-thirds of the fall potato crop is planted on the Norfolk coarse sandy loam.

The fall crop of snap beans is chiefly interplanted with strawberries on the Sassafras and Norfolk coarse sandy loams, while a large part of the pole lima bean crop is grown on the Norfolk gravelly loam.

Several characteristic features of the cropping system followed in the section around Diamond Springs are shown by the two maps.

Approximately one-half of the total area mapped is used for the growing of general farm crops and truck crops; the remainder is in forest, gardens and grounds, orchards, and the experimental plots, or else is unoccupied for farming purposes.

The truck crops occupy about one-third of the total area, both in fall and in spring. Among these crops, strawberries cover the largest acreage, except during the winter months, when the acreage in spinach is slightly larger.

The considerable acreage given to cabbage growing is notable.

The subordinate position of potatoes in both spring and fall and of kale among the fall crops is marked.

The growing of snap beans, interplanted with strawberries, is a feature of the cropping on the coarse sandy loam soils.

The relatively large area given to forage and grain crops in the spring is in somewhat marked contrast with the conditions shown by the June crop map of the Churchland area. The larger area of heavy soils in the Diamond Springs area accounts for this, in part. The fact that corn frequently succeeds spinach, cabbage, and such strawberry beds as are plowed out after finishing their bearing period also influences the acreage of corn.

Comparison of the Churchland and Diamond Springs Areas.

Although the Churchland and Diamond Springs areas lie within a few miles of each other, under closely similar climatic conditions and with almost equal accessibility to shipping points, the two areas show some notable contrasts in the character of cultivation, especially with respect to the growing of truck crops.

The Churchland area is dominated by fine sandy loam soils which occupy over 95 per cent of its total area. The Diamond Springs area is marked by a considerable diversity of soil types. The loam soils cover 42 per cent of the total area; gravelly loams occupy 18 per cent; coarse sandy loams cover 30 per cent, and one fine sandy loam soil comprises but 8 per cent of the total area mapped. Thus, nearly 60 per cent of the total area consists of rather heavy soils.

In the Churchland area two-thirds of the upland area consists of naturally well-drained soils, while the other types have been decidedly modified with regard to drainage by the tile underdrainage. The soils of the Diamond Springs area may be grouped into three classes with respect to their natural drainage. The Sassafras loam, fine sandy loam, and coarse sandy loam and the Norfolk coarse sandy loam are naturally well drained. These four types occupy 43 per cent of the total area. The Norfolk loam and gravelly loam are only moderately well drained in their natural condition, and little artificial drainage has been installed. They cover 40 per cent of the total area. The Suffolk loam and gravelly loam are dis-

tinctly poorly drained. They cover approximately 14 per cent of the area.

These conditions of soil texture and of drainage are reflected strongly in the cropping of the two areas.

The Churchland area is one of very complete agricultural occupation. About 88 per cent of the upland is occupied by some crop. The area in forest is relatively small, amounting to about 4 per cent of the total. The greater part of this occurs in one tract upon the Suffolk fine sandy loam, to which artificial drainage has not yet been extended. In the Diamond Springs area cultivation occupies but 48 per cent of the total area, 30 per cent is in forest, and 17 per cent of the cleared area is occupied for experimental purposes or is not tilled. The occurrence of large tracts of forest on the Norfolk loam and gravelly loam and upon the Suffolk loam is notable. These types need additional drainage facilities to become available for the growing of any truck crops.

A comparison of the spring cropping conditions shows that 87 per cent of the Churchland area is occupied by truck crops, while 35 per cent of the Diamond Springs area is so cropped. Potatoes are by far the most extensively planted crop in the Churchland area, covering nearly 57 per cent of the ground. Strawberries are as emphatically the leading crop in the Diamond Springs area, occupying 15 per cent of the area. In both areas cabbage occupies second place. Snap beans, cucumbers, strawberries, and garden peas are the other important spring crops in the Churchland area. Potatoes and snap and pole lima beans are of importance in the Diamond Springs area.

In both areas the spring truck crops occupy a large proportion of the area available for farming.

The fall crop conditions in the two areas are not quite so directly comparable, since the surveys were made in two different years and not precisely at the same cropping period. Yet it is rather significant that kale leads among the fall truck crops in the Churchland area (Pl. X, fig. 2), while spinach leads in the Diamond Springs area. Strawberries, which occupy the land during the year, show a large fall acreage in the Diamond Springs area. In the Churchland area spinach and a fall crop of potatoes are almost equally important. In the Diamond Springs area the winter planting of cabbage for spring harvest is second to spinach in area, and the fall crop of potatoes is of rather small extent.

In the Churchland area only a moderate proportion of the available area is given to fall and winter crops, whereas in the Diamond Springs area the fall and winter cropping is almost equal to the spring area.

In the Churchland area the fall crops are somewhat concentrated on the Sassafras and Norfolk fine sandy loams. Kale and spinach are especially segregated on these types, while the fall potato crop occurs on the Norfolk and Keyport fine sandy loams.

In the Diamond Springs area nearly 70 per cent of the total acreage of fall and winter truck crops is found on the four best-drained soils, 51 per cent occurring on the two coarse sandy loams.

It thus appears that the growing of truck crops upon the different soils of the Norfolk trucking district is most strongly affected by drainage conditions resulting (1) from the texture of the soil types and (2) from the physical position of the soils with regard to natural or artificial outlets for drainage waters.

This results in the utilization of the coarser-grained and better drained types for the growing of winter crops or those which occupy the ground throughout the year; in the use of soils of intermediate texture, like the fine sandy loams for the growing of large areas of spring truck crops; and in the use of the loam soils and others of less perfect drainage for the growing of forage crops or in their remaining out of cultivation. The notable exception to this general condition is found in the case of the Sassafras loam. This type is naturally well drained and has been utilized extensively for truck crop production, although its texture is somewhat fine grained for such use.

Tables VI and VII show in detail the more important uses of each extensive soil type for the production of each important truck crop in spring and fall, respectively.

TABLE VI.—*Areas of important spring truck crops on the more important soils of the Diamond Springs areas.*

Soil type and crop.	Acres.	Per cent of type.	Soil type and crop.	Acres.	Per cent of type.
Sassafras coarse sandy loam:			Suffolk fine sandy loam:		
Strawberries	100.3	36.1	Potatoes	71.8	49.2
Cabbage	16.9	6.0	Cabbage	20.6	14.1
Potatoes	12.7	4.5	Beans[1]	6.2	4.3
Norfolk coarse sandy loam:			Sassafras loam:		
Strawberries	80.0	27.5	Strawberries	24.4	23.7
Potatoes	63.2	21.7	Cabbage	22.7	22.0
Cabbage	50.6	17.4	Norfolk loam:		
Sassafras fine sandy loam:			Strawberries	41.1	8.3
Potatoes	97.1	28.2	Cabbage	14.0	2.8
Cucumbers	27.7	8.0	Suffolk loam:		
Cabbage	18.9	5.5	Strawberries	14.2	7.3
Norfolk fine sandy loam:			Beans[2]	10.9	5.6
Potatoes	299.0	61.2	Norfolk gravelly loam:		
Cabbage	48.8	10.0	Beans[2]	25.1	9.5
Beans[1]	34.4	7.0	Strawberries	18.1	6.8
Keyport fine sandy loam:			Potatoes	14.2	5.4
Potatoes	123.4	58.6	Suffolk gravelly loam:		
Cabbage	48.3	23.0	Beans[2]	8.7	12.0
Cucumbers	15.3	7.3	Strawberries	4.4	6.1

[1] Snap beans. [2] Pole lima beans, chiefly.

TABLE VII.—*Areas of important fall truck crops on the more important soils of the Diamond Springs areas.*

Soil type and crop.	Acres.	Per cent of type.	Soil type and crop.	Acres.	Per cent of type.
Sassafras coarse sandy loam:			Keyport fine sandy loam:		
Strawberries [1]	76.6	27.5	Kale	27.9	13.3
Spinach	65.7	23.5	Potatoes	17.3	8.3
Norfolk coarse sandy loam:			Sassafras loam:		
Strawberries [1]	62.1	21.2	Spinach	54.7	53.5
Spinach	48.8	16.6	Strawberries [1]	10.8	10.6
Sassafras fine sandy loam:			Suffolk fine sandy loam, kale	8.4	5.7
Spinach	76.6	22.2	Norfolk loam:		
Kale	36.7	10.6	Spinach	27.9	5.6
Norfolk fine sandy loam:			Strawberries [1]	24.0	4.6
Kale	84.1	17.1	Norfolk gravelly loam:		
Potatoes	36.5	7.4	Strawberries [1]	16.2	6.1
Spinach	26.0	5.3	Spinach	13.0	5.0
Strawberries [1]	22.9	4.7	Suffolk gravelly loam:		
			Strawberries [1]	4.1	5.4
			Turnips	4.1	5.4

[1] Occupy the ground throughout the year.

SOILS PREFERRED FOR DIFFERENT TRUCK CROPS.

The soil and crop surveys of the Churchland and the Diamond Springs areas indicate a preference of certain soil types in the growing of certain crops. Such preference is brought out in the following recapitulation:

Potatoes.—Potatoes are the most important spring truck crop in the Norfolk district. The maps show a total of 746.7 acres in this crop. The four fine sandy loam types carry 591.3 acres, or 79.1 per cent of the total. The types constitute a little less than 35 per cent of the total area mapped. The fall crop of potatoes covers 88.8 acres, and of this total 53.8 acres consist of the Norfolk and Keyport fine sandy loams. This constitutes over 60 per cent of the area of the fall-grown crop. The preference for the fine sandy loam soils for potato growing is thus marked.

Strawberries.—The spring crop maps show a total area of 336.3 acres in strawberries. The Sassafras and Norfolk coarse sandy loams carry 180.3 acres of strawberries, or nearly 54 per cent of the total acreage, although they cover less than 20 per cent of the total area mapped. The Sassafras loam is the only other important type used for strawberry growing within the sections mapped.

Cabbage.—The cabbage crop occupies 260.8 acres, rather evenly distributed on the Keyport fine sandy loam, the Norfolk coarse sandy loam, and the Norfolk fine sandy loam. Over 56 per cent of the crop is found on these three types.

Beans.—The spring crop of snap beans occurs largely on the Norfolk fine sandy loam, while the pole lima bean crop is chiefly on the Norfolk gravelly loam. The latter crop is exceptional in the Norfolk district.

Cucumbers.—Out of a total acreage of 70.2 acres of cucumbers, 43 acres, or 61.2 per cent, consist of the Sassafras and Keyport fine sandy loams.

Spinach.—Spinach is the most extensively grown winter truck crop in the Norfolk district. The total area in the two areas mapped is 328.3 acres. The Sassafras loam carries 54.7 acres, or 52.1 per cent of its total area, in spinach; the Sassafras coarse sandy loam 65.7 acres, or 23.5 per cent of its area; the Sassafras fine sandy loam bears 76.6 acres, or 22.2 per cent of its total extent; and the Norfolk coarse sandy loam carries 48.8 acres, or 16.6 per cent of its total area. From this it follows that the best-drained soils of the Norfolk district include nearly 75 per cent of the spinach area mapped in the two surveys.

Kale.—Kale is the other winter crop of importance in the Norfolk district. A total area of 188.2 acres is accredited to this crop, chiefly in the Churchland area. The Norfolk, Sassafras, and Keyport fine sandy loams carry a total of 148.7 acres, or 79 per cent of all of the kale mapped. They cover about 42 per cent of the area surveyed.

Only the more sandy soils are desired for the growing of watermelons and cantaloupes.

Sweet potatoes, cucumbers, and peas show quite a range of desirable soil conditions, with a rather marked preference for sandy loams and even for sands.

The preferred soils for potatoes and beans are very decidedly the sandy loam types. The production of the latter crop on loams is also indicated.

The preferences of soils for strawberries range toward the sandy loam and the loam soils, although heavier soils may be used.

Spinach and kale are preferably grown upon the heavier and more loamy soils.

SOIL PREFERENCES EXPRESSED BY FARMERS OF THE NORFOLK DISTRICT.

To ascertain the preferences of local farmers for the different classes of soils in growing the more important truck crops, a series of circular letters was sent out. The more important facts in the replies to these letters are discussed below.

Potatoes.—Replies were received from 32 growers who reported upon a total acreage of 1,636 acres. Twenty-five growers, or 78 per cent of those reporting, express a preference for sandy loam soils for potatoes, while the remaining 7, or 22 per cent, prefer a loam. In several instances distinction is made between the crop grown for extra early market and that for later harvesting. In all cases the sandy loam soils are preferred for the early crop. The yields reported by these 32 growers range from 30 barrels per acre to a maximum of

S-6248

FIG. 1.—CABBAGE ON KEYPORT FINE SANDY LOAM, NEAR PORTSMOUTH, VA.

S-8474

FIG. 2.—CORN AND COWPEAS, FOLLOWING EARLY POTATOES, ON NORFOLK FINE SANDY LOAM, NEAR CHURCHLAND, VA.

S-8492

FIG. 1.—VOLUNTEER HAY (CRABGRASS), FOLLOWING EARLY CROPS OF POTATOES OR CABBAGE, NEAR CHURCHLAND, VA.

S-6265

FIG. 2.—PLANTING COWPEAS AS A SUMMER GREEN-MANURING CROP, AFTER EARLY CABBAGE, ON NORFOLK FINE SANDY LOAM. CEDAR HEDGE AS A WINDBREAK, NEAR CHURCHLAND, VA.

S-8226

FIG. 1.—PICKING STRAWBERRIES ON SASSAFRAS COARSE SANDY LOAM AND NORFOLK LOAM, NEAR DIAMOND SPRINGS, VA.

S-8232

FIG. 2.—PACKING STRAWBERRIES GROWN ON SASSAFRAS FINE SANDY LOAM, NEAR DIAMOND SPRINGS, VA.

S-8259

FIG. 1.—PICKING SNAP BEANS ON NORFOLK FINE SANDY LOAM, NEAR CHURCHLAND, VA.

S-8459

FIG. 2.—BUSH AND POLE LIMA BEANS ON NORFOLK GRAVELLY LOAM, DIAMOND SPRINGS AREA, VA.

S-8444

FIG. 1.—SPINACH, ON THE SASSAFRAS FINE SANDY LOAM, NEAR DIAMOND SPRINGS, VA.

S-9517

FIG. 2.—KALE, ON THE NORFOLK FINE SANDY LOAM, NEAR CHURCHLAND, VA.

100 barrels. The estimated mean production is about 60 barrels. It must be remembered that the spring crop is harvested to bring the largest cash return per acre and that this is accomplished by digging a part of the crop at an early date to obtain the higher prices, while the rest of the crop, harvested at a later date, produces a larger yield per acre, but is sold at a lower price. Thus, the 30-barrel yields represent chiefly the earliest digging, while the larger yields result from permitting the crop to come more nearly to maturity. Under the system practiced in the Norfolk district, it is evident that, within reasonable limits, yield per acre is affected chiefly by the date of harvest.

The methods of management employed with the potato crop are evidently very uniform in the district. The early crop of potatoes is usually followed by a summer crop. In many cases volunteer grass, chiefly crab grass, is permitted to occupy the land and later harvested for forage. In other cases the land is occupied immediately after the harvesting of the potatoes by a crop of corn or by corn with cowpeas or soy beans sown in alternate rows. Following the harvest of the summer crop, either a winter truck crop is planted or, in some cases, rye and crimson clover are used as winter cover crops. The common practice, however, is to follow potatoes with a summer forage crop and then use the land for a winter truck crop.

Fertilization for the potato crop is practically standardized in the Norfolk district. Under normal conditions a commercial fertilizer, analyzing 7 per cent of ammonia, 6 per cent of phosphoric acid, and 5 per cent of potash, is used at the rate of 1,200 to 2,000 pounds per acre. During the shortage of potash salts caused by the war the practice was to increase the amount of phosphoric acid. A common formula being 7 per cent ammonia and 8 or 9 per cent phosphoric acid with no potash or, in a few instances where it could be obtained, 1 to 3 per cent potash.

Stable manure is used for the potato crop, so far as it is obtainable. It is chiefly purchased from local sources of rather limited supply. (See Pl. XI, figs. 1 and 2.)

Careful cultivation of the potato crop is the rule in the Norfolk district. Poisons are applied to control the potato beetle and some of the more progressive farmers spray with Bordeaux mixture to counteract the blight.

It should be noted that the Norfolk district produces the Irish Cobbler almost exclusively for the spring crop of potatoes, and grows a relatively small acreage of "Peach Blow" potatoes as a fall crop.

Cabbage.—Replies were received from 19 growers, representing a total of 242 acres of cabbage. Five of the replies, or 26 per cent of those reporting, indicate a preference for a sandy loam soil for cabbage

growing; 12 growers, or 63 per cent of the number answering, prefer a loam soil; and 2 growers, or 10 per cent, prefer a clay soil for cabbage production.

The yields of cabbage reported range from 100 to 250 barrels per acre, with an indicated mean production of about 200 barrels.

There is considerable diversity in the methods of management of the cabbage crop in the Norfolk district. To an appreciable extent cabbage is planted along the shoulders of the spinach beds as soon as the greater part of that crop has been harvested. Some growers plant cabbage upon land from which a summer crop of corn or hay has been harvested. Others follow various short rotations.

Usually there is no interval in which to grow a green-manuring crop in preparation for cabbage.

The most common method of fertilization for cabbage is to use a moderate application of the fertilizer commonly employed for potatoes at the time of transplanting the cabbage. This is followed at intervals through the winter and early spring by applications of a fertilizer analyzing 10 per cent of ammonia, 5 to 7 per cent of phosphoric acid, and 2 or 3 per cent of potash.

The more soluble sources of ammonia are used in the winter fertilizers, as the crop is subject to cool conditions under which the surface soil may be frozen for short periods. The total applications of commercial fertilizer for cabbage range from 500 to 2,000 pounds per acre with a mean of about 1,500 pounds. Stable manure is used if available.

The earliest spring crop of cabbage is handled with special reference to the promotion of growth during the winter and spring. The crop is set as spinach is removed and a high ridge is plowed up on the northern side of the cabbage row for the purpose of protecting the young plants from cold winds and to intercept and reflect the sunlight. Later in the season the ridge is worked down and the winter applications of fertilizer are made. The crop thus handled is available for early shipment. This early crop is set only upon the best drained and warmest soils, chiefly the coarse and fine sandy loams of the district. A later crop is planted on the heavier soils or those not quite so well drained naturally. Thus the cabbage crop may be grown on quite a variety of soils, ranging from the best drained members of the Sassafras and Norfolk series, used for the early crop, to the dark sandy loams and loams of the Suffolk and Portsmouth series, which give a large yield at a somewhat later date in the spring.

Strawberries.—The replies of 20 growers, representing 304 acres of strawberries, show no decided preference in the selection of soils for this crop. Seven prefer a sandy loam, 7 a loam soil, and 6 a heavy loam or clay soil. This is in general accord with the observations in the district. It is probable that strawberries are grown

upon a wider range of soil types than any other important crop in the Norfolk section.

The yields reported range from 35 to 75 crates, of 32 quarts each, per acre, with a mean of about 60 crates.

Strawberries are usually set in the late winter or early spring, the plants being obtained from established beds. During the first year it is a rather common practice to interplant either beans, peas, or potatoes in the new beds. The cultivation and fertilization of the berries suffice for these crops and some use is made of the land while the new bed is becoming established.

Usually no opportunity is afforded in this system for the turning under of a green manuring crop. Stable manure is used to a rather small extent.

The use of commercial fertilizer on strawberries and the accompanying crops is general. From 500 to 2,000 pounds per acre is applied, both the amount and the mixture used varying considerably. Not infrequently the formula is chosen with regard to the accompanying crop. The 7–6–5 formula, used for potatoes, or the 10–5–3 formula, used for winter forcing, is commonly applied to strawberries at different stages of their growth.

The earliest crops of berries are generally picked from the coarse sandy loam and the fine sandy loam types. Later crops are obtained from the dark sandy loam and the loam soils of the Suffolk and Portsmouth series. In some cases the best drained and earliest truck soils upon the individual farm are used for the winter and early spring truck crops, while strawberries, which occupy the land for two years, are set on heavier and later soils, where they will not interfere with the short rotations used for the other crops grown. This explains in part why strawberries are grown under a wider range of soil conditions than any other crop in the district.

Beans.—Snap or string beans are an important crop in the Norfolk trucking district both in spring and in fall. Replies from 18 growers were received, representing 154 acres of beans. Four of the replies indicate a preference for a distinctly sandy soil and 10 for a sandy loam soil. Three prefer a loam and one a clay loam. Twenty-two per cent desire a sand and 55 per cent a sandy loam soil; thus 77 per cent of the answers indicate a choice of a well-drained, warm soil for this crop.

Snap beans are marketed chiefly in half-barrel hampers or baskets. The yields reported range from 50 to 200 baskets per acre, with a mean of 100 to 150 baskets.

A considerable part of this crop is grown as an interplanting with new strawberry beds, but a large acreage is also grown alone, especially in the spring. The fertilization of the crop consequently varies. In general, commercial fertilizer is applied at a rate of 500

to 1,000 pounds per acre. The formula varies, but either the usual potato fertilizer or that applied for winter forcing is most commonly employed.

Peas.—Garden peas are chiefly grown as a spring crop. Eleven replies to inquiries were received representing 83 acres of this crop. Eight growers prefer either a sandy soil or a sandy loam for peas, while three express a preference for a loam. As in the case of beans, over 70 per cent of the replies call for a warm, well-drained soil.

Peas are marketed in bushel baskets, and the replies show a range in yield of 30 to 80 baskets per acre, with a normal production of about 50 baskets.

Peas are also grown as an interplanted crop to a considerable extent and are fertilized with reference to the accompanying crop. The amounts of commercial fertilizer range from 300 to 400 pounds to 1,000 pounds per acre.

Cucumbers.—Cucumbers are grown both as a field crop and under frames. (See Pl. XII, figs. 1 and 2.) The methods of management differ very markedly in the two cases. The producers growing the crop under frames require a light sandy soil, and all the manuring and fertilizing is on an intensified scale. As much as 50 to 60 tons of stable manure per acre may be used for the forcing crop, together with heavy applications of soluble fertilizers. After the earliest part of the crop is harvested and all danger of frost is over, the frames are removed and the vines are allowed to spread, producing a later crop. The yields from this form of production are heavy and not at all comparable with those of the field crop.

The 16 replies concerning the cucumber crop were chiefly from those producing the field crop. Thirteen growers, or 80 per cent, prefer either a sandy soil or a sandy loam for the crop. Three are in favor of a loam soil.

The yields under field conditions range from 50 to 150 barrels per acre, with a mean of about 100 barrels.

In practically all cases stable manure is used in considerable amounts. In addition commercial fertilizers are used at a rate of 500 to 1,500 pounds per acre, with a normal application of about 1,000 pounds.

Sweet potatoes.—Of the 15 replies received from growers of sweet potatoes, 13, or 87 per cent, state a preference for a sandy soil or a sandy loam for this crop.

While sweet potatoes are rather a subordinate crop in the Norfolk district, a considerable acreage is grown, especially at points where marketing facilities are not quite so favorable as to permit of the more intensive forms of truck growing. Usually the individual acreages within the trucking district are small.

The reports indicate an average yield of 60 to 70 barrels per acre. Manure is quite generally used for this crop, with a supplementary application of 500 to 1,000 pounds of commercial fertilizer. The formula employed varies, ranging from a mixture analyzing 2–8–6 to the 7–6–5 formula commonly used on Irish potatoes.

Cantaloupes.—Only six replies were received with respect to cantaloupes, but it is notable that all indicate a preference for a sandy or sandy loam soil.

Watermelons.—Five replies with respect to watermelons; all express a preference for a sandy soil.

Spinach.—Replies were received from 17 growers, representing a total of 559 acres of spinach. Seven, or 41 per cent, prefer a sandy loam soil; 6, or 35 per cent, prefer a loam; and 4 growers, or 24 per cent, prefer a heavy loam or clay.

The yields reported range from 50 to 400 barrels per acre, with a mean of about 200 barrels.

Spinach is the most extensively grown of the strictly winter truck crops. There is some variation in the methods of production, although the greater part of the acreage follows a summer forage crop, either volunteer hay or a crop of corn or of corn and cowpeas.

The land is plowed, harrowed, and thrown up into narrow, flat-topped beds early in the fall and the spinach seeded while there is time for a strong growth before the colder winter weather sets in.

Stable manure, so far as it can be obtained, is used for the crop, but the chief dependence is placed upon commercial fertilizers. These are applied at the rate of 1,000 to 2,000 pounds per acre, the most common application being 1,000 to 1,200 pounds. A part of the application is made just before seeding, but additional applications are made during the winter whenever warm weather permits. The fertilizer used for this winter crop usually contains 10 per cent of ammonia, derived from soluble sources, from 4 to 8 per cent of phosphoric acid, and 2 to 4 per cent of potash.

It is coming to be a common practice in the Norfolk district to apply from 500 to 1,000 pounds of lime in some form, at the time the spinach beds are prepared.

Kale.—Kale is second only to spinach in the Norfolk district as a winter truck crop. Replies were received from 15 growers, representing 177 acres of kale. Of these, 3, or 20 per cent, prefer a sandy loam soil; 11, or 73 per cent, express preference for a loam soil; and 1 prefers a clay soil.

The yields reported range from 200 to 300 barrels per acre, with an average of about 250 barrels.

Kale is most commonly planted after a summer crop of volunteer hay or after corn. The planting is made in the early fall and the crop makes the greater part of its growth early in the season. The

harvest begins in December and cutting is continued through the winter.

Stable manure is used for the crop of kale to such an extent as it can be obtained. Commercial fertilizer is applied to an aggregate amount of 1,000 to 2,000 pounds per acre. About 500 pounds is applied at the time of planting and additional top dressings are made during the winter months. The first application is frequently of the common formula for potatoes, 7–6–5, while the winter mixture consists of the more soluble goods, also used for cabbage and spinach.

The preferences expressed by growers for certain classes of land for growing the particular truck crops are summarized in Table VIII.

TABLE VIII.—*Soil preferences expressed by farmers.*

Crop.	Number of replies.	Sand.		Sandy loam.		Loam.		Clay.	
		Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Watermelon	5	5	100.0						
Cantaloupe	6	1	17.0	5	83.0				
Sweet potato	15	3	20.0	10	67.0	2	13.0		
Cucumber	16	3	20.0	10	60.0	3	20.0		
Peas	11	2	18.0	6	55.0	3	27.0		
Potatoes	32			25	78.0	7	22.0		
Beans	17	4	22.0	10	55.0	3	17.0	1	6.0
Spinach	17			7	41.0	6	35.0	4	24.0
Strawberries	20			7	35.0	7	35.0	6	30.0
Cabbage	19			5	26.0	12	63.0	2	10.0
Kale	15			3	20.0	11	73.0	1	7.0

Although the number of replies received was too small to give a decisive answer to the question of local soil preferences for the different truck crops, yet the grouping of the preferences is rather significant.

GENERAL CONCLUSIONS.

The study of the Norfolk trucking district indicates very clearly that the different classes of farming and the production of the different crops are closely related to the differences in drainage conditions which exist within the district.

These drainage conditions are controlled by (a) location with respect to the natural outlets, (b) the altitude and slope of the land surface, and (c) the texture or relative porosity of the soil and subsoil. The classification of the soils of the district is closely related to these features.

The soils of the Sassafras and Norfolk series are relatively well drained. They lie chiefly in positions near the natural drainage outlets, along the shore line and the larger tidewater embayments, They occupy positions of some elevation above water level. They vary in texture to a considerable extent, and this variation, which establishes the individual soil type, exerts a considerable influence

upon the utilization of the different soils of these series for the growing of crops.

The soils of the Keyport and Suffolk series are not naturally well drained. They occupy flat upland areas at some distance from the more pronounced drainage channels. They are chiefly of fine-grained texture, ranging from fine sandy loam to loam and silt loam. Only areas where artificial drainage has been installed are well suited to the production of truck crops. Other areas are used for growing forage crops or else remain in forest.

The soils of the Portsmouth series are naturally poorly drained, large tracts remaining in a semiswampy condition. They are chiefly found in depressed and level areas in positions around stream heads or remote from the deeper-cut stream ways. They are chiefly forested. Where artificial drainage has been established they are used for the growing of forage crops and of some truck crops.

The detailed studies of the relationships between soil types and crops indicate a selection of certain soils for specific crop uses.

The Sassafras coarse sandy loam, occurring on low elevations and ridges, is esteemed as a year-round trucking soil. Two-thirds of its area within the limits of the surveys is cleared and over one-half is used for truck crops, both winter and spring. Strawberries lead in acreage. Spinach is the most important winter truck crop on this type. Important areas of cabbage, early potatoes, and snap beans are also encountered. The total area of the type in the Norfolk district is of rather limited extent.

The Sassafras fine sandy loam, occurring on level or gently sloping uplands, near the deeper stream ways, is a highly prized soil for truck crop production. Approximately two-thirds of its area is under cultivation. For spring truck crops over one-half of its area is utilized, and in summer and fall about 36 per cent of its area is used for trucking. Potatoes and cucumbers are the most important spring crops; spinach and kale lead among winter crops. Cabbage and a spring crop of snap beans are also grown. The area given to strawberries within the limits of these surveys is small.

The Sassafras loam is of limited extent within the surveys and in the general district. It occurs on level areas near well-established drainage ways. Because of this position it is chiefly cleared and used for the growing of truck crops. Two-thirds of its area is thus utilized in both fall and spring. Strawberries lead in acreage, while cabbage and potatoes are important spring crops. Spinach is the chief winter truck crop, occupying more than one-half of the area of the type.

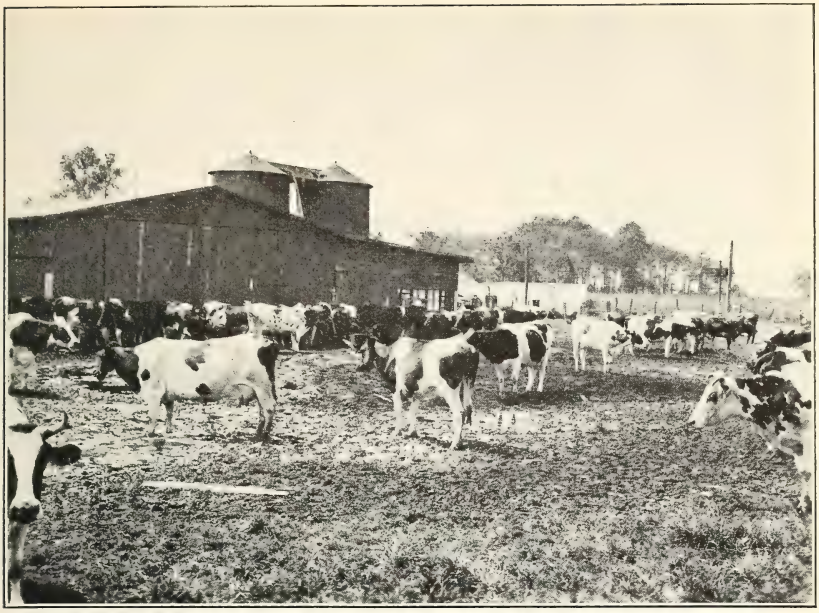
The Norfolk coarse sandy loam, found on low ridges and gentle upland slopes, is a preferred soil for trucking purposes. Over 70 per cent of its area is cleared and almost entirely occupied for the growing

of truck crops. Strawberries lead in acreage within the area mapped. Potatoes and cabbage are the other important spring crops; spinach leads among winter crops. Kale is grown to a small extent.

The Norfolk fine sandy loam is the most important trucking soil encountered in the surveys or in the district. It occurs chiefly upon level, well-drained uplands, contiguous to tidewater. Within the limits of the detailed surveys, over 90 per cent of its area is under cultivation. In the spring practically all of this area is used for truck crop production. In the late summer and early fall, forage crops occupy rather more than one-half its extent. Potatoes are the most important spring truck crop on the Norfolk fine sandy loam, occupying 58.6 per cent of the part of the type included in the detailed survey. It is safe to say that they constitute at least one-half of the spring truck crop acreage on the type throughout the Norfolk district. Cabbage is second in importance, covering 10 per cent of the area surveyed. Snap beans and strawberries cover the other important areas. Among fall and winter truck crops, kale is by far the most important on the Norfolk fine sandy loam in the Churchland area and it is extensively grown on the type in the district. Fall crops of potatoes and spinach are next in importance.

Norfolk loam, extensively developed within the limits of the Diamond Springs area and in the general district, is usually found upon level uplands or slight ridges and is moderately well drained in its natural condition. Within the limits of the detailed survey less than one-third of its area is cleared and commonly used for crop production. Over 40 per cent is in forest or cut-over land, and a considerable part of the land once cleared is not regularly used for cropping. In the general district it is probable that a somewhat larger proportion of the type is regularly tilled, chiefly to general farm crops. Within the area surveyed about one-half of the cropped area is occupied by forage crops and one-half by truck crops. Among these, strawberries are of greatest extent, and small areas of cabbage, potatoes, and spinach are also grown. Corn, either grown alone or with cowpeas interplanted, is the most important forage crop. Corn, cowpeas, winter oats, sorghum, and even cotton are produced on this type within the district

The Norfolk gravelly loam is of small extent, either in the areas surveyed or in the district as a whole. It occurs as small areas chiefly associated with the Norfolk loam. About one-half of its area in the Diamond Springs area is cleared and cropped. This is greater than the normal proportion. The type is not desired as truck soil and its chief use for such purposes is made by colored farmers. Lima beans, strawberries, early potatoes, and some spinach are grown. Corn is the most important forage crop, occupying the largest area of any of the crops grown.

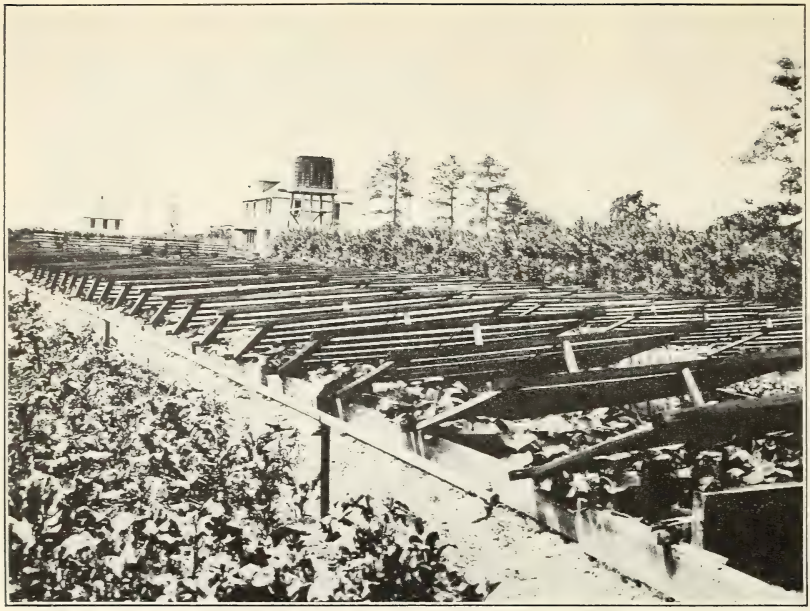


S-8530

FIG. 1.—DAIRY FARMING ON THE SUFFOLK LOAM, NEAR NORFOLK, VA. THE HEAVIER SOIL TYPES ARE USED FOR FORAGE CROP PRODUCTION.

S-8462

FIG. 2.—STABLE MANURE, USED FOR TRUCK GROWING, NEAR CHURCHLAND, VA.



S-8241

FIG. 1.—EARLY CUCUMBERS, GROWN UNDER SASH, ON NORFOLK FINE SANDY LOAM, NEAR PORTSMOUTH, VA.

S-8353

FIG. 2.—FIELD CROP OF CUCUMBERS ON SUFFOLK FINE SANDY LOAM, NEAR CHURCHLAND, VA.

The Keyport fine sandy loam occupies a moderate area in the Churchland survey. It is found to some extent throughout the Norfolk district in moderately drained localities on the level upland usually somewhat remote from the main drainage ways. It is available for trucking when artificially drained and is used for growing general farm crops or remains in forest when not so improved. In the area surveyed the type has all been underdrained by tile and is occupied nearly to its extent by various crops. Over 95 per cent of its area is in truck in the spring. Potatoes are the most important crop grown, covering nearly 59 per cent of the soil. Cabbage is second in importance. Cucumbers, snap beans, and strawberries are the other crops grown. In the late summer and fall two-thirds of the type is occupied by forage or green-manuring crops. Volunteer hay and corn, either alone or with cowpeas and soy beans, are chiefly grown. Kale is the most important winter truck crop. Fall potatoes, spinach, and a fall crop of beans are also grown.

The Suffolk fine sandy loam is of rather small area in the region. It is not naturally well drained and occupies level to slightly depressed areas. Underdrainage is requisite to render it available for trucking. In the Churchland area it has been drained and three-fourths of its extent is used for spring truck crops. Potatoes are the leading crop, occupying nearly one-half of its area. Cabbage is important. Snap beans, strawberries, and cucumbers are also gown on the type. Kale is the only fall crop grown extensively on it. It carries a high percentage of corn and volunteer hay as summer crops.

The Suffolk loam is of small extent within the areas mapped, but occupies much larger areas to the south of the trucking district. It is naturally poorly drained, occupying level tracts at some distance from the more pronounced stream ways. In general it is either forested or occupied chiefly for the growing of forage crops. Only about one-third of the area mapped as this soil is cleared and cultivated. This area is about equally divided between general farm crops and a variety of truck crops, chiefly strawberries, grown by colored farmers.

The Suffolk gravelly loam is an unimportant type in the district. It is poorly drained and chiefly in forest. The cleared area mapped is used by colored farmers for growing forage crops and truck crops.

No important areas of soils of the Portsmouth series are included within the two detailed surveys. In general the Portsmouth sandy loam, fine sandy loam, and loam occupy extensive tracts somewhat to the south of the region of intensive truck farming. They are poorly drained naturally and chiefly remain in forest. Small areas within the trucking district and larger areas where drainage has been established have proved to be of considerable value for the growing of certain truck crops. The spring crop of potatoes, straw-

berries, and cabbage are the most important crops grown. The summer and fall crops are chiefly corn or corn and cowpeas. There is abundant evidence that the Portsmouth sandy loam and fine sandy loam are well suited to potato growing when good drainage can be provided. Large crops are obtained at nearly as early a date as upon the fine sandy loams of better natural drainage.

It is thus apparent from a study of the soils of the Norfolk trucking district that fine sandy loam soils dominate in total extent and are the preferred soils for truck-crop production. The Norfolk fine sandy loam is the most important trucking soil. Upon it the greater part of the early Irish potato crop is grown. It is an important cabbage soil. Strawberries are successfully grown. Snap beans, peas, cucumbers, radishes, beets, and cauliflower are also grown. It is used in summer for egg plant, tomatoes, and cantaloupes. It carries a large acreage of kale and spinach in the winter months.

The Sassafras fine sandy loam is of much less extent, but is also a highly prized trucking soil. Its crop uses do not differ materially from those of the Norfolk fine sandy loam.

The coarse sandy loams are of decidedly smaller extent than the fine sandy loams in the district. They are very fully occupied for truck crop production, especially for the growing of the winter crops of spinach and kale. Strawberries cover the largest acreage in the areas mapped, but this is not held to be the general rule. Potatoes are not grown on either the Norfolk or Sassafras coarse sandy loam to as great extent as upon the fine sandy loams. Cabbage and snap beans are important crops.

The loam soils differ with respect to truck-crop production. The small areas of well-drained Sassafras loam are occupied nearly to their full extent for the growing of strawberries, cabbage, and spinach. The Norfolk loam, not usually well drained, is largely forested or used for the growing of general farm crops. Strawberries, potatoes, cabbage, and spinach are successfully grown on the best-drained parts of the type.

The gravelly loams are of very limited extent in the district and are not esteemed for trucking.

Large areas of the soils of the Keyport, Suffolk, and Portsmouth series remain in forest. Well-located areas, either drained or capable of drainage, are available for truck-crop production, especially for growing potatoes, strawberries, and cabbage.

Limitations in drainage, caused by position and soil texture, chiefly control the distribution of truck-crop production in the Norfolk district and strongly influence the distribution of the various crops upon the well-drained and moderately drained types of soils.

THE EASTERN SHORE TRUCKING DISTRICT OF VIRGINIA.

LOCATION.

The two counties of Accomac and Northampton in Virginia, located between Chesapeake Bay and the Atlantic Ocean, are commonly designated as the Eastern Shore of Virginia. This section comprises a total land area of 682 square miles or 436,480 acres. It is bounded on the north and northwest by Worcester and Somerset Counties, Md., on the east by the Atlantic Ocean, and on the west by Chesapeake Bay and its tributaries.

The production of truck crops, and of forage and general farm crops grown in conjunction with such crops, constitutes the chief agricultural industry of these counties. The magnitude of the trucking industry is shown by the statistics of truck-crop production for the section. The following estimate of shipments of various truck crops is furnished by the Eastern Shore of Virginia Produce Exchange. It is probable that total shipments exceed even these totals, since some independent marketing of produce occurs.

TABLE IX.—*Production of truck crops in Accomac and Northampton Counties, Va., 1911 to 1916, inclusive.*[1]

Year.	Irish potatoes.	Sweet potatoes.	Onions.	Strawberries.	Cabbage.
	Bushels.	*Bushels.*	*Hampers.*[2]	*Crates.*[3]	*Crates.*[4]
1911	2,403,838	1,845,990	44,733	30,616	48,109
1912	4,598,170	2,874,231	89,828	81,508	48,727
1913	7,649,510	3,525,368	97,252	49,356	84,188
1914	7,083,664	2,281,623	65,095	45,778	110,395
1915	7,839,492	2,367,040	201,488	58,991	88,666
1916	7,719,249	3,736,983	69,156	48,610	90,156

[1] From Soil Survey of Accomac and Northampton Counties, Va., E. H. Stevens, Field Operations, Bureau of Soils, 1917.
[2] Hamper = five-eighths bushels.
[3] Strawberry crate = 32 quarts.
[4] Cabbage crate = two-thirds barrel, or 2 bushels. Some cabbage is also shipped in barrels.

Assuming moderate yields per acre for each of these crops, it is probable that the two counties plant annually about 65,000 to 70,000 acres to potatoes, 20,000 to 25,000 acres to sweet potatoes, around 1,000 acres to strawberries, and about 500 acres each to onions and cabbage. These estimates probably are somewhat below rather than above the total plantings. Small areas of beans, cantaloupes, and watermelons are also grown.

The total area of improved land in farms shown for the two counties by the census of 1910 is 128,775 acres. The area in truck crops, as estimated, ranges from 87,000 to 97,000 acres, or somewhere between 67 and 75 per cent of the total improved land. Few trucking areas show such a high percentage of truck-crop occupation as this, and few of them exceed the Eastern Shore in total area given to the growing of truck crops.

Stevens, in the Soil Survey of Accomac and Northampton Counties, Va., calls attention to the progressive change from the growing of general farm crops to the production of truck crops on page 17 of his report.

It should also be remembered that there is rather less duplication of acreage in truck-crop production in these two counties than in other localities. The potato crop is commonly followed by corn or some other forage crop; sweet potatoes require the use of the ground for the entire growing season; strawberries occupy the land for two years or more, and only onions are marketed at a sufficiently early date to permit of duplication of trucking area.

CLIMATE.

Climatic records for this important trucking area are rather scanty. Records for Norfolk, Va., Wachaprague, Va., and Pocomoke City, Md., indicate a well-distributed rainfall ranging from 49.5 inches at Norfolk, and 39.6 at Pocomoke City, to 34.3 inches at Wachaprague, which lies between the two and within the area under discussion. The heaviest rainfall occurs during the growing season and is so well distributed that severe droughts are uncommon. The mean annual temperature for the two counties is about 57° F. with long, warm summers and only brief spells of severe weather during the prevalently mild winters.

The frost data for the three stations indicate a frost-free season of 230 days at Norfolk, 219 days at Wachaprague within the area, and 185 days at Pocomoke City inland and north of the section. It is probable that over the greater part of the Eastern Shore counties of Virginia the growing season is approximately 220 days.

The influence of the large bodies of water so nearly surrounding these counties is strongly felt in the equalization of climatic conditions. Summer heat is decreased by cool sea breezes, the cold of winter is tempered by the proximity of large bodies of relatively warm water, and the seasonal extremes of heat and cold are reduced. This influence of adjacent water bodies is especially pronounced in the narrow lower extremity of Northampton County, where tidewater is nowhere at a greater distance than 3 or 4 miles from the farms farthest inland. Consequently the growing season is appreciably longer from the vicinity of Eastville southward, than in the more northern part of the section. The same influence is noticed with respect to farms situated along the coast lines of both counties as contrasted with those lying in the interior.

Some localization of truck-crop production and certain differences in farm practice result from these local differences in climatic conditions.

TRANSPORTATION AND MARKETS.

The growth and development of the trucking industry on the Eastern Shore of Virginia, as elsewhere along the Atlantic coast, has been to a high degree dependent upon the facilities afforded for the marketing of crops. The earlier agriculture of the region was dependent upon shipment by water from points, principally on creeks tributary to Chesapeake Bay, which afforded steamboat communication. The crops grown under these conditions were chiefly the staple farm crops which would stand storage and gradual marketing. With the building of the railroad in 1884 along the approximate axis of these two counties, rapid transit facilities were provided for the shipment of perishable commodities. The growing of truck crops had already been begun in a limited way, but the expansion was decidedly rapid after rail transportation was provided. At the present time few farms within the two counties are located at a distance of more than 5 miles from either rail or steamboat transportation and the great majority of the farms are within easy hauling distance of some shipping point.

The New York, Philadelphia, & Norfolk Railroad and its connections afford access to all of the metropolitan markets of the north and northeast. The distances from Cape Charles to Philadelphia and New York, respectively, are 220 and 310 miles. In addition, a frequent steamboat service connects Chesapeake Bay points with Baltimore in 12 to 18 hours from the time of departure. Thus, all points in the two counties are well served by transportation.

The market outlets for the majority of shipments of truck crops from the Eastern Shore of Virginia are found in Philadelphia, New York, Boston, and the other great cities of the Northeastern States, although shipments are also made to points farther west and north, even to the Canadian Provinces, when market conditions justify.

An important factor in the marketing of truck crops from these two counties is the association of farmers known as the Eastern Shore of Virginia Produce Exchange. This corporation, formed by the truckers, possesses a central organization which keeps close touch with the acreages and probable dates of shipment of the various crops, maintains a wire service for the collection and distribution of market information, and establishes grades and brands for the produce. It also standardizes grading, handles directly a considerable proportion of the marketing and collections, and offers facilities for local sales of certain products, notably strawberries. This cooperative association of truck growers has tended to stabilize conditions not only from time to time during the shipping season, but also, through its information concerning reserve stocks and probable market conditions, from year to year. Consequently, the Eastern Shore of Virginia counties have shown steady, healthy growth in this industry.

AGRICULTURAL POPULATION.

The white population of the Eastern Shore is almost exclusively of English descent. The region was settled during the first third of the 17th century by English colonists, and their descendants comprise the greater part of the present population. In addition, there is a considerable negro population, chiefly engaged in farm labor.

The region possesses no large cities but is closely dotted with small towns and villages on the water courses and along the railroad. Manufacturing is of decidedly subordinate importance, agriculture and fisheries dominating the industry of the locality. It may almost be said that every inhabitant of the two counties is more or less directly interested in agriculture, as the secondary employments largely contribute in some form to the conduct of agricultural operations.

PHYSICAL FEATURES.

The Eastern Shore of Virginia is a long, low peninsula, extending southward from the Maryland line for a distance of 75 miles to the extremity at Cape Charles. The highest elevations within the area do not exceed 50 feet, while the greater part of the area lies at altitudes between 35 feet and actual tide level. In spite of these narrow ranges in altitude, there are several rather distinct divisions of surface.

The coast line along the Atlantic Ocean consists of a series of long, narrow islands forming a barrier between the ocean and the continuous mainland. These islands are occupied by ranges and masses of sand dunes, with marshes and glades. They are usually separated from the mainland by broad stretches of salt marsh or by shallow tidewater lagoons or by both. In some cases the sand-dune area abuts directly upon the mainland.

The greater part of the Chesapeake Bay foreland is formed by long, narrow peninsulas or "river necks," separated by winding estuaries or embayments. The land areas are usually flat topped and of low altitude. Several large and small islands of low elevation fringe this shore. Along the southern end of this border there are also present some sand-dune areas, particularly from Cape Charles City southward.

A similar but not very distinct zone of low forelands borders the larger estuaries and tidal embayments of the central portion of the eastern coast line.

The remainder of the mainland consists of a nearly level to gently undulating upland, relieved only by low ridges, which range from a few yards to 500 or 600 feet in width. The eastern and western borders of this upland are roughly marked by the courses of the Seaside and Bayside highways, respectively. Topographically there is an escarpment of gentle slope and low elevation which is marked on the western side and obscure or even lacking on the eastern border of this upland.

The more elevated ridges are irregular in their direction, and in many places include poorly drained or even marshy basin-shaped depressions. The ridges, themselves, are commonly rather sandy and are the best drained areas of the two counties. Some of the ridges show evidences of a slight accumulation of wind-blown sand, but the majority, together with the intervening hollows or levels, probably represent irregularities of the ancient sea bottom.

Over the greater part of the upland erosion is very slight. It is only in the extreme northeastern part of Accomac County, where the higher elevations occur near the coast line, that streams have cut their channels pronouncedly and that the slope of their channels is marked. Elsewhere the level or basin-shaped stream-heads on the divides are drained by tortuous streams of indistinct channels which become more marked and less swampy as the heads of the tidewater estuaries, into which they usually flow, are approached.

Drainage is moderately established over the central upland. It is frequently poorly established in the central portions of the broader river necks. It is best along the shoulders of the descents to tidewater channels and along the low inland ridges. Drainage is excessive in the sand-dune areas and almost absolutely lacking in the majority of the tidal marsh areas. A part of the land area along the Chesapeake Bay shore line lies so near to tide level that extra high tides, accompanied by strong winds, drive tide water over areas which are normally land surfaces.

The differences in these natural drainage conditions exert a controlling influence on the character of the soils of the Eastern Shore of Virginia and consequently upon the degree and kind of agricultural development which has taken place.

SOILS.

Five principal soil series are encountered in the Eastern Shore counties of Virginia. They are all of common occurrence in the more northern portions of the Atlantic Coastal Plain and are found to a considerable extent throughout the Maryland-Delaware-Virginia Peninsula. These are the Sassafras, Norfolk, Keyport, Elkton, and Portsmouth series of soils. In addition there are areas of tidal marsh, fresh-water swamp, and dune sand, none of which, in their present condition, are agricultural soils.

The characteristics of the soils of the Sassafras, Norfolk, Keyport, and Portsmouth series have already been described in connection with the Churchland and Diamond Springs districts. The Sassafras series is represented on the Eastern Shore by four types, the Sassafras sandy loam, fine sandy loam, loamy sand, and loam. The Norfolk fine sand is the only representative of that series and it is of small extent and importance. The Keyport sandy loam, fine sandy

loam, and loam were mapped in the two counties. The Portsmouth series is represented to a limited extent by the sandy loam and the loam.

Soils of the Elkton series are rather widely distributed in these two counties, as well as elsewhere on the Peninsula. The surface soils of this series are gray to ash-colored; the subsoils are pale gray, mottled with yellow and rusty brown stains. The subsoil is usually underlain by gray, sandy material, frequently saturated with water. The subsoil is usually compact and stiff but not especially plastic. Three types, the Elkton sandy loam, fine sandy loam, and loam were encountered in the soil survey of Accomac and Northampton Counties. Some areas of fresh-water swamp also occur.

The tidal marsh areas do not form an integral part of the agricultural upland area.

The dune sand is too coarse textured to retain sufficient moisture for the needs of ordinary agricultural crops, and it does not contribute to the tilled area of the section.

Among these different soils drainage and its consequent modifications of soil characteristics constitute the most important distinctions, controlling the extent and kind of agricultural occupation to a marked degree.

The Norfolk fine sand and the soils of the Sassafras series are the best drained agricultural soils of the region. They are generally cleared and occupied for some form of cropping. The soils of the Keyport series are fairly well drained and, by the use of open farm ditches, are rendered suitable for the production of the majority of crops common to the latitude. The soils of the Elkton series always require supplementary drainage to suit them to cropping, and even then their crop uses are somewhat restricted. They are not so extensively tilled as soils of the preceding series. The soils of the Portsmouth series are swampy or semiswampy in their natural condition, and, as yet, only small areas have been provided with adequate artificial drainage and brought under cultivation. Such areas as have been improved are usually included within areas of more valuable soils. The tidal marsh and swamp are undrained and utilized to only a small extent for pasture. Dune sand is of little agricultural value.

DETAILED CROP AND SOIL MAP.

Onley Area.

To make a detailed study of the characteristic agricultural soils of the Eastern Shore of Virginia counties, particularly with respect to their uses for truck crop production, a soil and crop survey of a small area around Onley in Accomac County was undertaken in 1916. This detailed survey covers 1,777 acres, or approximately 2¾ square

miles. It is centrally located on the crest of the broad, low divide within the main upland of the county and is crossed from northeast to southwest by the line of the New York, Philadelphia & Norfolk Railroad. The altitude of the railroad station at Onley is given as 44 feet above tide level.

The surface of the area is but slightly relieved. The greatest differences of elevation are not more than 15 to 20 feet, and there are no steep slopes within the area except for a short distance along both banks of the small creek which drains the area and leaves its limits near the southeastern corner.

Holding in mind that the extreme relief is but slight, the surface conditions may best be described as a low, broad rim of well-drained land, occupying the outer margins of the area, and a broad, flat, and slightly depressed basin which occupies the center of the survey immediately to the south of Onley and comprises the headwater basin of a small stream. It is not quite coextensive with the forested area shown to the south of Onley. Smaller depressions of a few acres in extent occur along the northeastern border of the survey.

Drainage is well established over all of the low ridge, but is not complete either in the larger or smaller basins, although artificial means to remedy this condition have recently been undertaken.

The distribution of the soils of the area closely follows these main features of drainage. The Sassafras sandy loam occupies the crest of the broad, low ridge; the Keyport sandy loam covers the more elevated level tracts; the Elkton sandy loam occupies the lower portions of the slopes to the basins and the greater part of those depressions; the Elkton loam is found in small patches in the centers of the basin areas; and the Portsmouth sandy loam occurs chiefly along the stream courses.

SOILS.

These five distinct soil types are developed in the area, although only three of them are of sufficient extent to be of agricultural importance. The following table shows their absolute and relative areas within the limits of the detailed map.

TABLE X.—*Areas of various soils in Onley area.*

Soil.	Acres.	Per cent.
Sassafras sandy loam	774.0	43.6
Keyport sandy loam	477.6	26.9
Elkton sandy loam	468.0	26.3
Elkton loam	20.4	1.1
Portsmouth sandy loam	37.4	2.1
Total	1,777.4	100.0

Sassafras sandy loam.—The surface soil of the Sassafras sandy loam, to a depth ranging from 8 to 15 inches, is a brown to grayish-brown medium sandy loam. The average depth of the surface soil in the Onley area is about 8 or 9 inches. It is slightly greater on level areas or on gentle slopes and somewhat less on the crests of low ridges. In the latter position the color is likely to be a pale yellowish brown and the soil in this situation contains a somewhat larger proportion of medium to rather coarse sand. Elsewhere the surface soil is somewhat loamy. The subsoil from about 9 inches in depth to 30 inches is a sticky reddish-brown sandy loam, containing a moderate amount of medium and fine sand and a rather high percentage of silt, together with some clay. It is retentive of moisture and of fertilizers. The deep subsoil from 30 inches to several feet in depth consists of an orange to reddish-brown loamy sand which sometimes contains a considerable quantity of fine gravel.

This important soil type occupies the higher elevations consisting of broad, low ridges, well-drained tracts of level land, and the particularly well-drained banks of streams which have cut below the level of the surrounding land. The texture of the soil, the presence of the sandy underlying layer, and the favorable location of the type have given rise to good natural drainage conditions. The reddish-brown to orange color of the subsoil furnishes a good indication that drainage has been and is excellent. The weathering of the included iron-bearing minerals has proceeded to an advanced stage and the material shows good aeration and drainage from the surface to a depth of more than 3 feet.

There are few or no slopes within the limits of the type which would interfere with cultivation, and erosion is not a problem on the Sassafras sandy loam either in the Onley area or anywhere within the borders of the Eastern Shore of Virginia counties. A slight amount of shifting of surface materials under wind action occurs over the highest crests of some of the low ridges unless they are well protected by vegetation, either growing crops or stalks. The effect of such movement is relatively unimportant.

The Sassafras sandy loam is the best drained, earliest, and warmest soil type suited to agricultural uses within the region. It is sought as the most desirable arable land, and the greater part of its area has been cleared and placed under cultivation. The chief exceptions consist of small forested areas and farm woodlots reserved for domestic use. In the Onley area 76.7 per cent of the Sassafras sand loam is occupied for some form of farm use, and only 23.3 per cent remains in forest. This proportion is about typical of the region as a whole.

Keyport sandy loam.—The surface soil of the Keyport sandy loam, to an average depth of 9 inches and ranging in depth to 12 inches, is

a grayish-brown sandy loam. The coloration of a freshly plowed field will vary from yellowish gray to gray and grayish brown, the latter color predominating. The immediate subsoil is usually a pale-yellow to grayish heavy sandy loam, in places faintly mottled in gray and yellow colors. Below a depth of 24 inches the subsoil is a mottled gray, yellow, and ocherous-brown sandy loam, which passes at about 36 inches into a grayish-yellow loamy sand.

The Keyport sandy loam is found over nearly level upland tracts and along the lower parts of gentle slopes, commonly intervening between more elevated areas occupied by the Sassafras sandy loam and the depressions occupied by soils of the Elkton series.

The texture of soil and subsoil is favorable to the establishment of drainage, but the position of the type and its altitude give rise to some accumulation of excess moisture by seepage from higher lying areas, while outlets are not well enough established to permit of the rapid removal of water at all seasons. The soil is moderately well drained in its natural condition and is usually capable of complete drainage with a minimum expense for ditching. Many crops may be grown upon the larger areas of this type without artificial drainage. For the earlier truck crops it should be ditched and tiled. Erosion occurs rarely within the limits of this type.

The Keyport sandy loam is a good general purpose soil and its best drained areas are also well suited to the growing of Irish potatoes and cabbage. It has been extensively cleared and occupied throughout these two Eastern Shore counties, and the survey of the Onley area shows that 67 per cent of its extent is utilized for some form of agricultural occupation, while only 33 per cent remains in forest. This is possibly a little higher percentage in cultivation than is common in the region.

Elkton sandy loam.—The surface soil of the Elkton sandy loam consists of 8 or 9 inches of gray to brownish-gray sandy loam, which appears pale gray to almost white when thoroughly dried out. It is rather coherent and has a tendency to form clods when tilled in a moist condition. The subsoil to a depth of 30 inches is a gray sandy loam, mottled with yellow and ocherous stains. The main body color is distinctly gray as distinguished from the prevailing yellow of the Keyport sandy loam. Below 30 inches the deep subsoil is a somewhat sticky gray sand, mottled with yellow. The deep subsoil is frequently moist to saturated.

The Elkton sandy loam occupies broad depressed areas having a level to slightly sloping surface. The type is found around the headwaters of streams and in small depressions within areas of the Keyport and Sassafras sandy loams. It also includes some small areas of more loamy material in small patches, usually less than an acre in extent.

The natural drainage of the Elkton sandy loam is interrupted and poor. Unless artificial drainage is resorted to, water stands upon the surface during parts of the winter and spring months and the type is slow to warm up in the spring even where some ditching has been provided. It is capable of drainage at a moderate cost over the larger areas, but some of the small depressions occupied by this soil are so completely surrounded by areas of other types, lying on low ridges, that the cutting of effective outlets to a sufficient depth is rather expensive. Consequently the larger areas are more frequently ditched than smaller areas, whose reclamation would scarcely repay the expense.

The texture of the soil is favorable to drainage operations and only topographic difficulties interfere with its more complete occupation. Drained areas of the type prove it to be a strong forage crop soil, and that certain of the late truck crops may be grown to advantage. The general condition of the type is well shown in the Onley area, where 59.0 per cent of its area remains in forest, although it is well located with respect to shipping facilities and there are no insurmountable obstacles to its drainage. The type, here and elsewhere on the eastern shore of Virginia, constitutes a valuable reserve of land which may be brought under cultivation by the establishment of community and farm drainage systems.

Elkton loam.—The Elkton loam consists of 6 to 10 inches of gray to light-brown silty loam, containing enough fine and medium sand to render it granular. The subsoil, to a depth of 24 inches, is a mottled gray and pale-yellow silty loam, rather compact and sticky. The deep subsoil is a mottled gray and yellow sandy loam which is usually moist and may be saturated.

The type is found in the Onley area in a few small, saucer-shaped depressions associated with the Elkton sandy loam and the Keyport sandy loam. It marks an accumulation of silty earth and of organic matter in the lowest parts of these depressions. It is poorly drained and of limited extent and importance. It is usually tilled in conjunction with other and better drained types and its uses in this area are not at all characteristic of the type. Where possible, it should be used for growing forage crops or late truck crops. Drainage would greatly improve its condition and, wherever the area concerned is large enough to justify the expense, should be supplied.

Portsmouth sandy loam.—The surface soil of the Portsmouth sandy loam, to a depth ranging from 5 to 15 inches, is a dark-gray to black sandy loam. A considerable quantity of partly decayed organic matter is visibly present. The subsoil is a gray sandy loam, sometimes faintly mottled with yellow, rusty stains. At a depth of about 30 inches, a gray, sticky sand is found. It is usually saturated.

The Portsmouth sandy loam occurs only along stream beds in the Onley area. It is either overflowed at times of heavy rain or is saturated with seepage water. It is not capable of drainage over the greater part of its extent, except by deepening and straightening of stream channels. It is of small extent and, at present, of little agricultural importance, being chiefly forested.

The important agricultural soils of the area are the Sassafras sandy loam, Keyport sandy loam, and Elkton sandy loam. Some small areas of Elkton loam attain to a most unusual agricultural use from their close association with these types.

It is because these types are characteristically found in the vicinity of Onley that the area was selected for detailed study. It is considered certain that the conditions found on the three main types within this area are rather closely representative of the general conditions under which they occur and are farmed throughout Accomac and Northampton Counties. This is evident from a comparison of the section with the detailed soil survey of the two counties.[3]

USES OF SOILS.

A detailed soil map and two crop maps were made of the Onley area to show the boundaries and extent of each distinct type of soil and to make possible the measurement of the areas of each different crop or form of occupation for each soil type. One crop map shows the normal crop distribution in July, when the maximum acreage of distinctly truck crops is to be encountered in this region. The other crop map shows the crop areas in September, after the main Irish potato crop has been harvested and typical fall conditions exist. If a third map showing conditions in the spring had been made it would probably show somewhat larger areas of such crops as cabbage, onions, and, possibly, strawberries, but the two maps presented give an idea of the more common uses of the different soils for cropping and of the relative importance of the different principal crops. They also indicate in a pronounced way some of the characteristics of crop rotation and double cropping which are common in the region.

Tables XI and XII show the absolute and relative importance of the different soil types and their uses for crop production.

[3] Soil Survey of Accomac and Northampton Counties, Virginia, E. H. Stevens, Field Operations, Bureau of Soils, 1917.

TABLE XI.—*Proportion of total area and of the area of each soil type occupied by various crops and groups of crops, Onley, Va., July, 1916.*

Crop and group of crops.	All soils.		Sassafras sandy loam.		Keyport sandy loam.	
	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.
General farm crops	205.4	11.6	91.0	11.8	71.4	15.0
Hay and pasture	46.4	2.6	24.2	3.2	19.6	4.1
Corn	113.4	6.4	55.8	7.2	32.0	6.7
Cowpeas	41.0	2.3	7.2	.9	19.0	4.0
Sorghum	3.2	.2	2.4	.3	.8	.2
Oats	1.4	.1	1.4	.2	.....	.....
Truck crops	783.2	44.1	438.8	56.4	226.0	47.3
Potatoes	410.0	23.1	236.0	30.4	128.0	26.8
Sweet potatoes	287.6	16.2	173.4	22.4	70.0	14.7
Strawberries	58.4	3.3	13.2	1.7	20.0	4.2
Onions	23.2	1.3	10.6	1.4	7.6	1.6
All other vegetables	4.0	.2	3.6	.5	.4	.....
No annual crops	788.8	44.3	246.2	31.8	180.2	37.7
Forest	655.4	36.8	180.2	23.3	158.0	33.1
Gardens and grounds	117.2	6.6	55.2	7.1	19.0	4.0
No crop	9.8	.6	7.8	1.0	1.2	.2
Orchard	6.4	.3	3.0	.4	2.0	.4
Grand total	1,777.4	.....	774.0	.....	477.6	.....

Crop and group of crops.	Elkton sandy loam.		Elkton loam.		Portsmouth sandy loam.	
	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.
General farm crops	40.0	8.5	1.6	7.8	1.4	3.7
Hay and pasture	1.2	.2	.8	3.9	.6	1.6
Corn	24.0	5.1	.8	3.9	.8	2.1
Cowpeas	14.8	3.2	.....	.....	.....	.....
Truck crops	106.8	22.8	12.4	60.8	1.2	3.2
Potatoes	42.0	9.0	3.4	16.7	.6	1.6
Sweet potatoes	38.2	8.2	6.0	29.4	.....	.....
Strawberries	21.6	4.6	3.0	14.7	.6	1.6
Onions	5.0	1.0	.....	.....	.....	.....
No annual crops	321.2	68.7	6.4	31.4	34.8	93.1
Forest	276.0	59.0	6.4	31.4	34.8	93.1
Gardens and grounds	43.0	9.2	.....	.....	.....	.....
No crop	.8	.2	.....	.....	.....	.....
Orchard	1.4	.3	.....	.....	.....	.....
Grand total	468.0	.....	20.4	.....	37.4	.....

TABLE XII.—*Proportion of the total area and of the area of each soil type occupied by various crops and groups of crops, Onley, Va., September, 1916.*

Crop and group of crops.	All soils.		Sassafras sandy loam.		Keyport sandy loam.	
	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.
General farm crops	546.5	30.8	297.8	38.5	171.2	35.9
Hay and pasture	43.8	2.5	27.6	3.6	14.0	3.0
Corn	381.8	21.5	224.0	29.0	118.0	24.7
Corn and clover	3.8	.2	.4	.....	3.4	.7
Corn and cowpeas	77.5	4.4	33.0	4.3	23.2	4.9
Cowpeas	32.4	1.8	11.0	1.4	7.4	1.6
Millet and cowpeas	3.8	.2	.8	.1	3.0	.6
Sudan and cowpeas	2.0	.1	.....	.....	1.8	.3
Sorghum	1.4	.1	1.0	.1	.4	.1
Truck crops	426.0	24.0	226.2	29.2	116.0	24.3
Potatoes	71.0	4.0	32.8	4.3	19.2	4.0
Sweet potatoes	287.2	16.2	173.2	22.4	70.8	14.9
Strawberries	62.4	3.5	15.8	2.0	25.0	5.2
All other vegetables	5.4	.3	4.4	.5	1.0	.2
No annual crops	804.4	45.2	250.0	32.3	189.8	39.8
Forest	655.4	36.8	180.2	23.3	158.0	33.1
Gardens and grounds	127.4	7.2	55.8	7.2	28.6	6.0
No crop	13.8	.8	9.6	1.3	1.2	.3
Orchard	7.8	.4	4.4	.5	2.0	.4
Grand total	1,776.9	.....	774.0	.....	477.0	.....

TABLE XII.—*Proportion of the total area and of the area of each soil type occupied by various crops and groups of crops, Onley, Va., September, 1916*—Continued.

Crop and group of crops.	Elkton sandy loam.		Elkton loam.		Portsmouth sandy loam.	
	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.
General farm crops	73.3	15.7	2.2	10.8	2.0	5.4
Hay and pasture	1.6	.3			.6	1.6
Corn	36.2	7.7	2.2	10.8	1.4	3.8
Corn and cowpeas	21.3	4.7				
Cowpeas	14.0	3.0				
Sudan and cowpeas	.2					
Truck crops	74.4	15.9	8.8	43.1	.6	1.6
Potatoes	18.0	3.8	1.0	4.9		
Sweet potatoes	37.2	8.0	6.0	29.4		
Strawberries	19.2	4.1	1.8	8.8	.6	1.6
No annual crops	320.4	68.4	9.4	46.1	34.8	93.0
Forest	276.0	59.0	6.4	31.4	34.8	93.0
Gardens and grounds	43.0	9.1				
No crop			3.0	14.7		
Orchard	1.4	.3				
Grand total	468.1		20.4		37.4	

SOIL AND CROP ACREAGES FOR JULY.

It will be noted from the tables that the absolute acreage of each crop or other form of land occupation is given for the entire area and for each soil type in detail. There is also shown the relative extent of occupation in each case in the form of percentages of the entire area or of the particular soil type. The percentage figures for the entire area establish a basis for comparison for all soils of the locality. It is thus possible to study any departures from the normal practice and to compare the uses of any particular soil for the growing of individual crops or groups of crops.

The July crop map shows a total area of 783.2 acres given to truck crops, or 44.1 per cent of the entire area. Almost an exactly equal area, 788.8 acres, or 44.3 per cent, is occupied by forest and homesteads or is not cropped. The remainder, 205.4 acres, or only 11.6 per cent of the area, is used for the growing of forage crops or for pasture. The most extensive single form of land occupation is that of forest, which covers 655.4 acres, or 36.8 per cent of the area mapped. The greater part of this forest land consists of the Elkton sandy loam and Portsmouth sandy loam, the latter type being forested to 93.1 per cent of its extent. The Sassafras sandy loam has only 23.3 per cent of its area in forest. Excluding the Elkton loam, a total area of 20.4 acres, the other types are relatively cleared and occupied in a degree closely comparable with their natural drainage conditions.

The July table shows the relative importance of the different crops grown. The area in Irish potatoes, amounting to 410 acres, constitutes 23.1 per cent of the total area and 41.5 per cent of the area in annual crops. Sweet potatoes occupy 287.6 acres or 16.2 per cent of the surveyed area, or 29.1 per cent of the cropped area. Corn,

covering 113.4 acres; strawberries, 58.4 acres, and cowpeas, 41 acres, are the other important crops. It will be noted that the area occupied by gardens and grounds is greater than the area given to corn in the early summer months.

The distinctive features of the area as a whole are found to be:

1. The occupation of 55 per cent of the total area for cropping.
2. The occupation of 80 per cent of the total cropped area by truck crops, while the general farm crops cover but 20 per cent.
3. The fact that Irish and sweet potatoes include 71.6 per cent of the entire cropped area.

These facts are closely representative of the general conditions in Accomac County. The relative importance of sweet potatoes is greater and that of Irish potatoes is somewhat less than in Northampton County.

A comparison of the acreage figures for the different crops on the individual soil types with those for the entire area provides a basis for the study of the selective use of different soils for different crops.

Sassafras sandy loam.—The Sassafras sandy loam bears annual crops to the extent of 68.2 per cent of its area, compared with 55.7 per cent for the entire area surveyed. Only 23.3 per cent remains in forest, compared with 36.8 per cent for the entire map. Irish potatoes occupy 30.4 per cent and sweet potatoes 22.4 per cent of its area, compared with 23.1 and 16.2 per cent for the total survey. Corn is also slightly in excess of the standard, as are onions and pasture. Other crops fall below the average. The type may thus be characterized as a preferred trucking soil, especially desired for growing the two most important crops of the region. (See Pl. XIII, figs. 1 and 2, and Pl. XIV, fig. 1.)

Keyport sandy loam.—The Keyport sandy loam bears annual crops to the extent of 62.3 per cent of its area, or slightly in excess of the standard. Irish potatoes occupy 26.8 per cent of its extent, a little above the normal; sweet potatoes fall a little below, with 14.7 per cent, as against 16.2 for all soils. Both the total area of truck crops and that of forage crops slightly exceed the normal for the area at the expense of forested lands and homestead areas. The type is evidently considered to be rather more favorable for the growing of Irish potatoes than of sweet potatoes. (See Pl. XIV, fig. 2, and Pl. XV, fig. 1.) A slight preference is given strawberries also.

Elkton sandy loam.—The Elkton sandy loam is distinguished by the forest occupation of 59 per cent of its area, while 22.8 per cent is given to truck crops and 8.5 per cent to general farm crops. All of the truck crops fall below the normal percentage for the region except strawberries, which cover 21.6 acres, or 4.6 per cent of its extent compared with a standard percentage of 3.3. The forage crops also fall below the normal, with the exception of cowpeas,

which are slightly above. It is evident that, in the local judgment, the Elkton sandy loam is not a good trucking soil except for strawberries and that it is not even highly esteemed for the growing of forage crops.

Elkton loam.—The Elkton loam is not typically occupied within the limits of the Onley survey. The small areas found lie within the limits of fields dominated by other soils and they are tilled in accordance with the requirements of the more important types. Hence, 68.6 per cent of the area of the type is cropped, an entirely unusual condition. Sweet potatoes are found on 29.4 per cent of its area, although this soil is not usually considered a good one for the crop. The presence of a rather high percentage of strawberries (Pl. XV, fig. 2) and of a relatively large area of corn and hay is more nearly in accordance with the local cropping practices on the Elkton loam. Generally, on the Eastern Shore of Virginia, the Elkton loam is rather extensively forested and the cleared areas are most commonly used for the growing of forage crops, especially such as can be planted well along into the summer season when the type has had an opportunity to dry out.

Portsmouth sandy loam.—The presence of forest on 93.1 per cent of the area of the Portsmouth sandy loam is characteristic of the region. Its adventitious use for the growing of hay, for pasture, and for small areas of Irish and sweet potatoes is in accord with the general treatment of the type elsewhere in the two Eastern Shore counties. This soil is not commonly cleared and utilized except as small areas of it occur within the limits of other soils better suited to the common cropping systems of the region.

Viewed from the standpoint of individual crops, the soil facts become even more striking. The following summary by crop areas and percentages brings out this relationship:

The Sassafras sandy loam comprises 774 acres or 43.6 per cent of the entire area of the survey. It carries the following acreages and percentages of leading crops:

	Acres.	Per cent of crop.
Irish potatoes	236.0	57.6
Sweet potatoes	173.4	60.3
Strawberries	13.2	22.6
Onions	10.6	41.4
Miscellaneous vegetables	3.6	90.0

The Keyport sandy loam occupies 477 acres or 26.9 per cent of the area. It carries the following acreages and percentages of leading crops:

	Acres.	Per cent of crop.
Irish potatoes	128.0	31.2
Sweet potatoes	70.0	24.4
Strawberries	20.0	34.2
Onions	7.6	32.8
Miscellaneous vegetables	0.4	10.0

The Elkton sandy loam covers 468 acres or 26.3 per cent of the area. It carries the following acreages and percentages of leading crops:

	Acres.	Per cent of crop.
Irish potatoes	42.0	10.2
Sweet potatoes	38.2	13.3
Strawberries	21.6	37.0
Onions	5.0	21.5

These crop relationships show clearly that the Sassafras sandy loam is preferred for growing Irish potatoes, is greatly preferred for the sweet potato crop, is about normal for growing onions, and is used for the production of the greater part of the miscellaneous vegetables.

The Keyport sandy loam is an approved Irish potato soil, is slightly discriminated against for sweet potato production, and is a preferred soil for strawberries and onions.

The Elkton sandy loam is discriminated against for both Irish and sweet potatoes, is a strongly preferred strawberry soil, and neither chosen nor avoided for onions.

No information regarding the cabbage crop and little regarding onion production can be obtained from this map. Cabbages are chiefly grown in the southern part of Northampton County. The largest acreage of onions is normally found in the vicinity of Onancock, Accomac County. Moreover, both crops are chiefly harvested at an earlier season than that of the Onley map. Stevens' survey of the two counties would indicate that the Sassafras sandy loam and fine sandy loam are known to be the types chosen for winter cabbage production and that both the Keyport sandy loam and the Sassafras sandy loam are used for onion growing.

SOIL AND CROP ACREAGES FOR SEPTEMBER.

Some very striking changes in crop occupation become evident when the crop map for July is compared with that for September. The area in forest remains the same, the area in orchard is slightly increased, as is also that not occupied at the time by annual crops.

The total cropped area changes little, since 54.8 per cent of the total area is still occupied by annual crops, but the distribution is quite different. The truck crops have been largely harvested, their area sinking to 24 per cent of the total, while forage crops increase to 30.8 per cent. There is no change in the relative importance of sweet potatoes, as digging begins in September. The acreage in Irish potatoes is only 71 acres, compared with 410 acres in July. The crop is almost entirely harvested between July and September and its place is taken by a fall crop of Irish potatoes, grown for seed, and by a greatly increased acreage of corn and of corn and cowpeas, planted together. A number of other forage crops in small acreage also appear.

These changes in total crop acreage for the different crops reflect the common cropping practices of the region. The early Irish potato crop is interplanted with corn, and the fields, just before digging the potatoes, constitute the "potato-corn" characteristic of Eastern Shore of Virginia potato growing. (See Pl. XVI, fig. 1.) After the potato crop is harvested, the corn occupies the land, and some growers also sow cowpeas or crimson clover between the rows of corn. (See Pl. XVI, fig. 2.) Other forage crops are grown to a small extent, as upon fields where onions or cabbage have been harvested. Some of the potato or onion land is set to new fields of strawberries and the berry fields which have reached the limit of profitable production are plowed out and either a forage crop is grown or the land is reset to berries.

These changes in crop occupation are very evenly distributed over the different soil types so that no special feature in fall cropping appears as distinct from the spring and summer conditions. The regularity of cropping systems and practices is strongly indicated by this fact.

SOIL PREFERENCES EXPRESSED BY FARMERS.

A series of circular letters was sent out to ascertain the preferences of farmers in different parts of the two counties for different classes of soils used in the growing of the important truck crops. From the replies received the more important facts concerning the different crops were tabulated.

It is evident that the reports from these representative growers, the evidence obtained by Stevens for his report on the Soils of Accomac and Northampton Counties, and the data obtained by means of the detailed soil and crop map of the Onley area, Virginia, are well in accord.

The salient points of soil preference, as given by the growers, are shown in Table XIII.

TABLE XIII.—*Classes of soils preferred by growers for various crops.*

Crop.	Sandy loam.		Loam.		Heavier.	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Sweet potatoes	51	86.5	5	8.5	3	5.0
Onions	10	66.7	5	33.3		
Potatoes	41	58.6	28	40.0	1	1.4
Cabbage	6	30.0	14	70.0		

As in the case of the Norfolk district, the Eastern Shore growers show a progressive choice in soil textures for these crops. In both cases the more sandy soils, sandy loams, are preferred for sweet potatoes; both sandy loam and loam soils are desired for Irish

potatoes; while the loam soils are preferred decidedly for cabbage production.

In comparing these districts with those farther to the north, it should be held in mind that early marketing is a prime requisite for both the Norfolk and the Eastern Shore districts, so that a somewhat more sandy and early soil is desired for potato growing than in the case of the New Jersey areas. Even in that district there is a strong tendency to use the Sassafras sandy loam for growing Irish Cobblers and heavier soils for other and later varieties. The same type is the preferred Cobbler soil on the Eastern Shore, while fine sandy loams are preferred and more extensively used for growing the crop in the Norfolk district.

These well-drained and warm soils seem to combine earliness of maturity with moderate to high yields in the case of potatoes and to be the very best soils for truck crop potato growing in the Middle Atlantic Coast region.

Potatoes.—Seventy-one growers of potatoes reported 2,242 acres in this crop, or an average of 31.6 acres each. The most extensive grower reports 175 acres; the smallest, 1 acre. The acreages in the majority of cases are between 20 and 75 acres.

The reported yields of potatoes range from 35 to 110 barrels per acre, with the great majority of growers reporting 50 to 75 barrels. Many report yields of 80 to 100 barrels, and yields as large as this are undoubtedly obtained in numerous instances in both counties.

In the management of the potato crop the great majority of growers report the use of some winter cover crop on the land where potatoes are to be grown. The most common crop is rye, alone, or rye and crimson clover. Wheat also is used alone or with crimson clover or winter vetch. Oats are similarly used in some cases.

Stable manure is applied to potato ground, wherever obtainable, the home supply of manure being augmented in most cases by composting with pine needles, or "shatters," and with other forest litter. This practice is common in the two counties and woods refuse is so highly prized that nearly every farm retains a small woodlot within which the annual crop of pine needles and other refuse is carefully protected for use in composting with stable manure. (See Pl. XVII.)

The use of commercial fertilizer at the time these inquiries were made was greatly disturbed by war conditions, potash salts being practically unprocurable. The farmers were therefore asked to report the usual practice and any existing variations. From replies received it appears that the common formula for potato fertilizer is 7 per cent of ammonia, 6 per cent phosphoric acid, and 5 per cent potash, and that with a shortage of potash the proportion of

phosphoric acid is increased, a common mixture analyzing 7–6–0, 7–8–0, or in some cases 7–6–3. Extensive experiments with potato fertilizers within the two counties indicate strongly that this commonly used formula, 7–6–5, is best suited to the soils, crop rotations, and climatic conditions of the region. It is notable for the somewhat lower percentage of potash than in the formula used in more northern potato-growing regions. The large yields obtained on the Eastern Shore of Virginia abundantly justify this formula for the conditious existing there.

There is a wider variation in the amount of fertilizer applied per acre than in the formula used. The range, according to the replies received, is from 1,000 to 2,000 pounds per acre. By far the greater number of growers report either 1,200, 1,400, or 1,500 pounds per acre. Probably 1,400 pounds represents a fair average application in these two Eastern Shore counties.

Of 70 growers expressing opinion as to the proper soil texture for potato growing, 41 growers, or 58.6 per cent, prefer a sandy loam soil; 28 growers, or 40 per cent, prefer a loam soil, some stating that they prefer a dark loam; and only one prefers a clay loam. The distinct preference for a sandy loam soil is a very good reflection of the fact that the dominant soils of the region are of this class and it is in strict accord with the use of the Sassafras sandy loam, "red sandy loam," and the Keyport sandy loam, known as "dark loam," as shown by the detailed soil and crop map of the Onley area.

It should be noted that some extensive growers, who have drained some of the wetter and heavier soil types, find that under these conditions the heavier soils are well suited to growing a rather late crop but heavy yield of potatoes. The extension of potato growing on the Eastern Shore of Virginia will be made possible in part by such drainage and in part by the clearing of some of the forested areas of naturally better drained types. Both procedures are possible over extensive areas.

It should be said that the marked uniformity in farm practice in the growing of potatoes in this region is not due to chance. The experimental work of the Virginia Truck Experiment Station, with a branch farm at Tazely, the free interchange of experience which is made possible through the produce exchange, and the universality of the potato crop, which places practically every farmer in touch with his neighbors in the study of successful cropping practices, all tend to the rapid discarding of practices which do not prove to be profitable and to the adoption of a well-regulated use of crop rotations, cover crops, manures, and fertilizers, and a uniform method of cultivation and even of marketing the crop.

Thus the farm practice of the Eastern Shore of Virginia in growing potatoes has become practically standardized to include the following points:

For potato production use well-drained, sandy loam soils.

Grow a cover crop or green manuring crop on the land in the winter preceding the planting of potatoes—rye, wheat, or oats, and crimson clover preferred.

Use stable manure, composted with "shatters" and leaf mold, broadcasted over the field.

Apply, usually in the row, 1,200 to 1,500 pounds of a commercial fertilizer which, preferably, does not depart far from the standard formula of 7 per cent ammonia, 6 per cent phosphoric acid, and 5 per cent potash.

Cultivate clean and ridge up the crop.

Interplant corn in alternate middles before the crop blossoms.

Dig part of the crop early and allow the balance to come nearly to maturity.

Market the crop cooperatively.

These are the distinctive and common characteristics of Irish potato production in the two Eastern Shore counties of Virginia.

Sweet potatoes.—Replies were received from 62 growers of sweet potatoes, who report 810.5 acres. The individual acreage ranges from 1 to 72 acres, with the majority reporting from 5 to 20 acres. The average is about 13 acres for each grower reporting.

As in the case of Irish potatoes, the use of a cover crop in the rotation is almost universal. Rye or wheat and crimson clover predominate for this purpose. Manure is used wherever available, although a marked tendency to use the supply upon Irish potatoes is indicated.

The fertilizers used vary decidedly. The formulæ reported range from 2 to 7 per cent ammonia, from 5 to 11 per cent phosphoric acid, and from 0 to 10 per cent potash. The majority of the replies show that mixtures containing from 3 to 7 per cent ammonia, from 5 to 8 per cent phosphoric acid, and from 3 to 8 per cent potash are preferred. Some growers use the same formula as for Irish potatoes, but the majority use brands containing less ammonia.

The quantities applied also vary greatly, ranging from 300 to 1,400 pounds per acre, with the majority using from 500 to 800 pounds or considerably less than for Irish potatoes. The tendency of the plants to run to vines if large amounts of nitrogenous fertilizer are used is noted by some growers.

The reported yields of sweet potatoes range from 40 to 110 barrels per acre, the majority of the reports giving between 60 and 70 barrels.

The soil preferences are very definite. Fifty-one growers, or 86.5 per cent of all who express an opinion, prefer a sandy loam soil for the crop, five prefer a loam, and 3 some other class of soil.

It may be said that both the Sassafras and Keyport sandy loams are used for this crop. The former is generally preferred, but the latter may be used successfully, as it ordinarily dries out sufficiently

early to permit transplanting, and it is sufficiently well drained to produce a large yield of roots.

It is evident that the growing of sweet potatoes has not become as well standardized in this district as that of Irish potatoes. The crop is somewhat subordinate in importance, although coming to be grown more extensively. It fits in well with the growing of Irish potatoes and helps to distribute the employment of labor through the year. It can be recommended as a crop thoroughly well suited to the Sassafras sandy loam and to the better drained areas of the Keyport sandy loam.

Cabbage.—Only 22 answers were received with regard to the cabbage crop. These represent 72 acres, or an average of 3¼ acres for each grower. The acreage ranges from one-half acre to 12 acres each. The use of cover crops and manure is about the same as for potatoes.

The cabbage crop is a winter and early spring crop in this region and the fertilizer practice is adjusted to the cool growing conditions of the early part of the winter season. Growers use two different formulæ. The standard formula for application before transplanting, intended to carry the crop throughout the season, is almost uniformly the potato formula, 7–6–5. In addition, side dressings are made, during the colder months, of a mixture analyzing 10 per cent ammonia in some soluble form, 6 per cent phosphoric acid, and 5 per cent potash. The amount of fertilizer applied varies from 1,000 to 2,000 pounds per acre, with the majority of growers using about 1,500 pounds. Of this 1,000 pounds or more is of the 7–6–5 formula and 500 pounds or less contain the larger amount of soluble ammonia.

Fourteen growers, or 70 per cent, prefer a loamy soil for cabbage and 6 prefer a sandy loam soil. The yields reported range from 85 to 200 one-barrel crates per acre with an average production of about 150 barrels.

The cabbage crop is not sufficiently represented in the Onley area to afford verification of these expressed soil preferences, but they are well in accord with the general practice in cabbage growing.

Onions.—Sixteen growers report a total of 44 acres of onions. The individual areas range from 1 to 15 acres, the majority producing from 1 to 3 acres. The use of cover crops and manures preceding onions is general. The applications of fertilizer range from 500 to 1,700 pounds per acre, with 1,000 to 1,200 pounds predominating. The potato formula, 7–6–5, is dominant, although in the absence of potash several growers report the use of 7–8–0 or 5–8–0.

The reported yields range from 30 to 500 one-bushel crates, with an average of about 200 bushels per acre.

The onion crop is scarcely represented in the Onley area. It is grown more extensively in the vicinity of Onancock, where both the

Sassafras loam and fine sandy loam are used for onion culture. Of the 15 growers reporting, 10 prefer a sandy loam soil, and 5 a loam soil. For the early spring crop this preference is believed to be well founded.

RELATIONSHIP BETWEEN SPECIAL CROPS AND DEFINITE SOIL TYPES.

Table XIV summarizes the results of the surveys of the Churchland, Diamond Springs, and Onley areas for spring and summer crop conditions.

TABLE XIV.—*Proportion of total area and of the area of each soil type occupied by various crops and groups of crops: Churchland area, Va., June, 1916; Diamond Springs area, Va., June, 1916; Onley area, Va., July, 1916.*

Crop and group of crops.	All soils.		Sassafras coarse sandy loam.		Sassafras sandy loam.		Sassafras fine sandy loam.		Sassafras loam.		Norfolk coarse sandy loam.	
	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.
General farm crops	455.6	9.6	29.1	10.5	91.0	11.8	41.8	12.1	2.5	2.4	13.5	4.6
Corn	309.4	6.5	26.4	9.5	55.8	7.2	30.3	8.8	.....	.....	10.9	3.7
Hay and pasture	61.2	1.3	2.7	1.0	24.2	3.2	2.2	.6	.....	.....	2.6	.9
Cowpeas	49.0	1.0	.....	.....	7.2	.9	.....	.....	2.5	2.4	.....	.....
Wheat	15.1	.3	.....	.....	.....	.....	9.3	2.7	.....	.....	.....	.....
Oats	10.7	.2	.....	.....	1.4	.2	.....	.....	.....	.....	.....	.....
Soy beans	7.0	.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sorghum	3.2	.1	.....	.....	2.4	.3	.....	.....	.....	.....	.....	.....
Truck crops	2,400.0	50.4	152.6	54.8	436.8	56.4	178.2	51.8	69.3	67.3	198.8	68.3
Potatoes	1,135.6	23.9	12.7	4.5	236.0	30.4	97.1	28.2	4.8	4.7	63.2	21.7
Strawberries	394.7	8.3	100.3	36.1	13.2	1.7	6.2	1.8	24.4	23.7	80.0	27.6
Sweet potatoes	316.4	6.6	8.0	2.9	173.4	22.4	.....	.....	5.5	5.3	1.8	.6
Cabbage	260.8	5.5	16.9	6.0	.....	.....	18.9	5.5	22.7	22.0	50.6	17.4
Beans	123.8	2.6	10.0	3.6	.....	.....	12.3	3.6	3.6	3.5	1.5	.5
Cucumbers	70.2	1.5	.....	.....	.....	.....	27.7	8.1	.5	.5	.4	.1
All other vegetables	98.5	2.0	4.7	1.7	14.2	1.9	16.0	4.6	7.8	7.6	1.3	.4
No annual crop	1,903.8	40.0	96.5	34.7	246.2	31.8	124.2	36.1	31.1	30.2	78.8	27.1
Forest	1,273.3	26.8	58.2	21.0	180.2	23.3	45.6	13.3	11.8	11.5	56.4	19.4
No crop	360.1	7.6	21.8	7.8	7.8	1.0	42.7	12.4	16.7	16.2	10.2	3.5
Gardens and grounds	235.3	5.0	12.7	4.6	55.2	7.1	35.2	10.3	2.6	2.5	6.5	2.2
Orchard and vineyard	34.0	.6	3.8	1.3	3.0	.4	.7	.....	.....	.....	5.7	2.0
Swamp	1.1	.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Grand total	4,759.4	100.0	278.2	.....	774.0	.....	344.2	.....	102.9	.....	291.1	.....

Crop and group of crops.	Norfolk fine sandy loam.		Norfolk loam.		Norfolk silt loam.		Norfolk fine sand.		Norfolk gravelly sandy loam.		Norfolk gravelly loam.	
	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.
General farm crops	9.2	1.9	57.4	11.6	.....	.....	.....	.....	1.4	4.1	38.7	14.6
Corn	2.8	.6	44.0	8.9	.....	.....	.....	.....	.....	.....	32.8	12.4
Hay and pasture	.....	.....	4.0	.8	.....	.....	.....	.....	1.4	4.1	.....	.....
Cowpeas	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3.3	1.2
Wheat	.....	.....	5.8	1.2	.....	.....	.....	.....	.....	.....	.....	.....
Oats	.....	.....	3.6	.7	.....	.....	.....	.....	.....	.....	2.6	1.0
Soy beans	6.4	1.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Truck crops	438.3	89.8	67.2	13.6	.....	.....	6.4	68.8	3.9	11.2	95.2	36.1
Potatoes	299.0	61.2	6.0	1.2	.....	.....	6.4	68.8	.2	.6	14.2	5.4
Strawberries	31.2	6.4	41.1	8.3	.....	.....	.....	.....	3.5	10.0	18.1	6.8
Sweet potatoes	.....	.....	1.5	.3	.....	.....	.....	.....	.....	.....	6.9	2.6
Cabbage	48.8	10.0	14.0	2.8	.....	.....	.....	.....	.2	.6	6.6	2.5
Beans	34.4	7.0	1.7	.4	.....	.....	.....	.....	.....	.....	25.1	9.5
Cucumbers	11.8	2.4	.4	.1	.....	.....	.....	.....	.....	.....	5.1	1.9
All other vegetables	13.1	2.8	2.5	.5	.....	.....	.....	.....	.....	.....	19.2	7.4
No annual crop	40.8	8.3	370.8	74.9	9.0	100.0	2.9	31.2	29.3	84.7	130.1	49.3
Forest	.8	.2	200.3	40.4	.....	.....	.....	.....	25.5	73.7	65.1	24.7
No crop	13.1	2.6	165.6	33.5	9.0	100.0	.7	7.5	1.8	5.2	41.9	15.9
Gardens and grounds	26.9	5.5	3.1	.6	.....	.....	2.2	23.7	.4	1.1	13.8	5.2
Orchard and vineyard	.....	.....	1.8	.4	.....	.....	.....	.....	1.6	4.7	9.3	3.5
Grand total	488.3	.....	495.4	.....	9.0	.....	9.3	.....	34.6	.....	264.0	.....

S-8281

FIG. 1.—A GOOD CROP OF POTATOES ON SASSAFRAS SANDY LOAM, ACCOMAC COUNTY, VA.

S-8278

FIG. 2.—HARVESTING POTATOES ON SASSAFRAS SANDY LOAM, NEAR ONANCOCK, VA.

S-8339

FIG. 1.—SWEET POTATOES ON SASSAFRAS SANDY LOAM, NORTHAMPTON COUNTY, VA.

S-8286

FIG. 2.—POTATOES (IRISH COBBLER) ON KEYPORT SANDY LOAM, ACCOMAC COUNTY, VA.

S-8505

FIG. 1.—HARVESTING SWEET POTATOES ON KEYPORT SANDY LOAM IN ACCOMAC COUNTY, VA.

S-8523

FIG. 2.—STRAWBERRIES ON ELKTON LOAM, NEAR ONLEY, VA.

S-8418

FIG. 1.—"POTATO-CORN." IMMEDIATELY AFTER POTATO HARVEST. ON SASSAFRAS FINE SANDY LOAM, ACCOMAC COUNTY, VA.

S-8524

FIG. 2.—CORN AND COWPEAS ON SASSAFRAS SANDY LOAM, ACCOMAC COUNTY, VA.

S-8521

PINE NEEDLES AND FOREST LITTER SAVED FOR COMPOSTING WITH STABLE MANURE. A COMMON PRACTICE IN EASTERN VIRGINIA.

TABLE XIV.—*Proportion of total area and of the area of each soil type occupied by various crops and groups of crops; Churchland area, Va., June, 1916; Diamond Springs area, Va., June, 1916; Onley area, Va., July, 1916*—Continued.

Crop and group of crops.	Keyport sandy loam.		Keyport fine sandy loam.		Elkton sandy loam.		Elkton loam.		Suffolk fine sandy loam.		Suffolk loam.	
	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.
General farm crops	71.4	15.0	0.6	0.3	40.0	8.5	1.6	7.8	.....	.....	43.2	22.1
Corn	32.0	6.7	.....	.....	24.0	5.1	.8	3.9	.....	.....	39.7	20.3
Hay and pasture	19.6	4.1	.....	.....	1.2	.2	.8	3.9	.....	.....	1.5	.8
Cowpeas	19.0	4.0	.....	.....	14.8	3.2	.....	.....	.....	.....	1.8	.9
Oats	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.2	.1
Soy beans	.....	.....	.6	.3	.....	.....	.....	.....	.....	.....	.....	.....
Sorghum	.8	.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Truck crops	226.0	47.3	201.0	95.5	106.8	22.8	12.4	60.8	107.5	73.7	34.1	17.4
Potatoes	128.0	26.8	123.4	58.6	42.0	9.0	3.4	16.7	71.8	49.2	.9	.4
Strawberries	20.0	4.2	5.6	2.6	21.6	4.6	3.0	14.7	5.0	3.4	14.2	7.3
Sweet potatoes	70.0	14.7	.....	.....	38.2	8.2	6.0	29.4	.....	.....	1.6	.8
Cabbage	.....	.....	48.3	23.0	.....	.....	.....	.....	20.6	14.1	3.8	2.0
Beans	.....	.....	7.5	3.6	.....	.....	.....	.....	6.2	4.3	10.9	5.6
Cucumbers	.....	.....	15.3	7.3	.....	.....	.....	.....	3.9	2.6	.7	.3
All other vegetables	8.0	1.6	.9	.4	5.0	1.0	.....	.....	.....	.....	2.0	1.0
No annual crop	180.2	37.7	8.8	4.2	321.2	68.7	6.4	31.4	38.3	26.3	117.6	60.3
Forest	158.0	33.1	6.9	3.3	276.0	59.0	6.4	31.4	34.4	23.6	97.9	50.2
No crop	1.2	.2	.....	.....	.8	.2	.....	.....	1.1	.7	13.2	6.8
Gardens and grounds	19.0	4.0	1.9	.9	43.0	9.2	.....	.....	2.8	2.0	5.8	3.0
Orchard and vineyard	2.0	.4	.....	.....	1.4	.3	.....	.....	.....	.....	.7	.3
Grand total	477.6	.....	210.4	.....	468.0	.....	20.4	.....	145.8	.....	194.9	.....

Crop and group of crops.	Suffolk gravelly loam.		Portsmouth sandy loam.		Portsmouth loam.		Loamy sand.		Swamp.	
	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.
General farm crops	12.8	17.6	1.4	3.7	.....	.....	.....	.....	.....	.....
Corn	9.1	12.6	.8	2.1	.....	.....	.....	.....	.....	.....
Hay and pasture	.4	.5	.6	1.6	.....	.....	.....	.....	.....	.....
Cowpeas	.4	.5	.....	.....	.....	.....	.....	.....	.....	.....
Oats	2.9	4.0	.....	.....	.....	.....	.....	.....	.....	.....
Truck crops	30.1	41.7	1.2	3.2	9.9	83.9	24.3	95.7	.....	.....
Potatoes	3.1	4.3	.6	1.6	5.2	44.1	17.6	69.3	.....	.....
Strawberries	4.4	6.1	.6	1.6	1.9	16.1	.4	1.6	.....	.....
Sweet potatoes	3.5	4.8	.....	.....	.....	.....	.....	.....	.....	.....
Cabbage	3.1	4.3	.....	.....	2.4	20.3	3.9	15.3	.....	.....
Beans	8.7	12.0	.....	.....	.4	3.4	1.5	5.9	.....	.....
Cucumbers	4.4	6.1	.....	.....	.....	.....	.....	.....	.....	.....
All other vegetables	2.9	4.1	.....	.....	.....	.....	.9	3.6	.....	.....
No annual crop	29.3	40.7	34.8	93.1	1.9	16.1	1.1	4.3	4.5	100.0
Forest	14.2	19.7	34.8	93.1	.8	6.8	.....	.....	.....	.....
No crop	8.0	11.1	.....	.....	.....	.....	.....	.....	.....	.....
Gardens and grounds	3.1	4.3	.....	.....	.....	.....	1.1	4.3	.....	.....
Orchard and vineyard	4.0	5.6	.....	.....	.....	.....	.....	.....	.....	.....
Swamp	.....	.....	.....	.....	1.1	9.3	.....	.....	4.5	100.0
Grand total	72.2	.....	37.4	.....	11.8	.....	25.4	.....	4.5	.....

Truck crops occupy 50.4 per cent of the total land area included in the three surveys, general farm crops occupy 9.6 per cent, and 40 per cent of the area is not occupied by annual crops.

A considerable proportion of the entire area surveyed is thus not cropped, and it is desirable to compare crop acreages on the basis of their relationship to the cropped area as well as with respect to their proportionate place in the whole area.

It then appears that truck crops, which cover 50.4 per cent of the entire area, comprise 84 per cent of the cropped area.

Potatoes are the crop most extensively grown, occupying 23.9 per cent of the total and 39.7 per cent of the cropped area. They are the chief crop in both the Churchland and Onley areas, but in the Diamond Springs area are exceeded in acreage by strawberries, cabbage, and corn.

Strawberries are second in rank, occupying 8.3 per cent of the total and 13.8 per cent of the cropped area. They lead in acreage in the Diamond Springs area but are of decidedly secondary importance in both of the others.

Sweet potatoes cover 6.6 per cent of the entire area and 11.8 per cent of the cropped area. They are important only in the Onley area, are decidedly subordinate in the Diamond Springs area, and are not found in the Churchland area.

Cabbage occupies 5.5 per cent of the total area and 9.1 per cent of the cropped area. It is an important crop in the Churchland and Diamond Springs areas but practically lacking in the Onley area.

Beans are similarly confined to the Churchland and Diamond Springs areas. They occupy 2.6 per cent of the total area and 4.3 per cent of the cropped area. Owing to extensive interplanting of beans with other crops, this does not quite give the crop its true rank. Counting all areas of beans, those grown alone and interplanted with other crops, the percentages become 3 per cent of the entire area and 5 per cent of the cropped area.

Cucumbers, grown chiefly in the Churchland area and not at all in the Onley area, occupy 1.5 per cent of the areas mapped and 2.4 per cent of the cropped area.

All other vegetables cover 2 per cent of the total and 3.4 per cent of the cropped area.

It is evident that Irish potatoes constitute the most important truck crop in eastern Virginia, occupying 47.3 per cent of the entire acreage devoted to truck.

Corn is the only important general farm crop, covering 6.5 per cent of the total and 10.8 per cent of the cropped area. It is exceeded in area by potatoes, strawberries, and sweet potatoes. This condition is changed, however, when fall crop areas are examined, since corn, interplanted with the spring potato crop or following it, occupies 20 per cent of the total fall area and 33.6 per cent of the land then in crops. This constitutes one of the important features of the cropping of the region. It should be noted that each of the three surveys exhibits a good acreage of corn, either planted alone or with cowpeas or crimson clover. The Churchland area shows 264 acres; the Diamond Springs area, 225 acres; and the Onley area, 463 acres. Thus, at the proper time in the year, each of the districts makes

good provision for forage crops for the work stock, and this is accomplished without interference with the main business of growing truck crops for sale.

With respect to their total area, the three fine sandy loam types lead in the production of the potato crop, the Sassafras sandy loam is next in importance, and the Keyport sandy loam and Norfolk coarse sandy loam are least important among the more extensive soil types.

It should be held in mind that both the Keyport and Suffolk fine sandy loams have been provided with excellent systems of tile underdrains within the section covered by the Churchland area survey, and that these figures represent the two types at their best with regard to potato growing. This fact is of considerable importance, since there remain in the region very considerable areas of each of these soils which are thus proved to be of a high degree of usefulness for potato growing whenever proper drainage is installed.

Table XV summarizes the potato acreage of the three areas according to soil type.

TABLE XV.—*Acreage of potatoes, according to soil type, in the Churchland, Diamond Springs, and Onley areas, combined.*

Soil type.	Area planted.	Proportion of type occupied.	Proportion of cropped area of the type.	Proportion of total crop.
	Acres.	*Per cent.*	*Per cent.*	*Per cent.*
Norfolk fine sandy loam	299.0	61.2	66.8	26.2
Sassafras sandy loam	236.0	30.4	44.7	20.8
Keyport sandy loam	128.0	26.8	32.2	11.3
Keyport fine sandy loam	123.4	58.6	61.4	10.9
Suffolk fine sandy loam	71.8	49.2	66.8	6.3
Norfolk coarse sandy loam	63.2	21.7	36.0	5.6

Table XVI summarizes the data for strawberries.

TABLE XVI.—*Acreage of strawberries, according to soil type, in the Churchland, Diamond Springs, and Onley areas, combined.*

Soil type.	Area planted.	Proportion of type occupied.	Proportion of cropped area of the type.	Proportion of total crop.
	Acres.	*Per cent.*	*Per cent.*	*Per cent.*
Sassafras coarse sandy loam	100.3	36.1	55.2	25.4
Norfolk coarse sandy loam	80.0	27.6	36.0	20.3
Norfolk loam	41.1	8.3	33.0	10.4
Norfolk fine sandy loam	31.2	6.4	7.0	7.9

The two coarse sandy loams are clearly the preferred strawberry soils, while the crop is scattering on the other types encountered. It should be stated that strawberries are also grown extensively on

soils of the Portsmouth series somewhat to the south of the areas where the surveys were made, and that the crop is well suited to production on both the Portsmouth sandy loam and fine sandy loam, where these have been properly drained. Soils of the Keyport and Elkton series are also used for the production of the crop.

In Table XVII the data for the three areas, relating to sweet potatoes, are combined to show soil-type occupancy.

TABLE XVII.—*Acreage of sweet potatoes, according to soil type, in the Churchland, Diamond Springs, and Onley areas, combined.*

Soil type.	Area planted.	Proportion of type occupied.	Proportion of cropped area of the type.	Proportion of total crop.
	Acres.	*Per cent.*	*Per cent.*	*Per cent.*
Sassafras sandy loam	173.4	22.4	32.8	54.9
Keyport sandy loam	70.0	14.7	23.5	22.1
Elkton sandy loam	38.2	8.2	26.1	12.7

The Sassafras sandy loam is clearly the preferred sweet-potato soil in this region. There is no doubt that the crop could also be grown successfully upon the coarse sandy loams, and would be were it not that these soils are desired for strawberry growing and the production of the winter crop of cabbage. Either one of these crops interferes with the growing of sweet potatoes and the truckers evidently prefer them to the moderate profits which may be obtained from sweet potato growing.

Cabbage is grown rather indiscriminately upon the Norfolk coarse sandy loam, Keyport fine sandy loam, and Norfolk fine sandy loam, principally. The chief requirements seem to be a position sheltered against winter winds, fairly good drainage, and rather strong forcing by the use of fertilizers applied during the milder days of winter.

The relationships of spinach and kale to the different soils have been shown in the discussion of the Churchland and Diamond Springs areas. No distinctively winter truck crops are grown within the limits of the Onley survey.

GENERAL SUMMARY.

There are two important trucking districts in eastern Virginia, the Norfolk and the Eastern Shore districts.

The Norfolk district lies south of the James River and Chesapeake Bay. In this district from 50,000 to 60,000 acres of truck crops are grown annually.

The Eastern Shore district comprises the greater part of Accomac and Northampton Counties, and 85,000 to 95,000 acres of truck crops are annually grown in it.

Both areas receive an adequate amount of precipitation ranging from 40 to 50 inches a year. It is usually well distributed. The Norfolk district has a growing season between killing frosts of 230 days. The southern portion of the Eastern Shore district has a growing season of 210 to 220 days, while the remainder of the district has a growing season of 185 to 210 days. Close proximity to large bodies of tidewater results in favorable climatic conditions in both districts. The Norfolk district constitutes the most northern of the year-round trucking districts.

Shipments of truck crops are made from each district to all of the larger northern and northeastern cities and even to Canada. Both rail and water transportation are employed. Shipments are largely made through truckers' associations.

The trucking business is chiefly carried on by native white farmers with negro laborers.

The entire region is marked by low relief, rising not more than 50 feet above tide level. There are no great irregularities of surface, very little erosion, and the land is drained chiefly through deep-cut estuaries and small upland streams. Broad undrained areas exist upon the uplands between the more pronounced drainage ways.

The soils of the region are derived from the unconsolidated deposits of the Atlantic Coastal Plain and range in texture from sands and coarse sandy loams to rather heavy loams. Sandy loams and fine sandy loams predominate, constituting the chief areas used for intensive agricultural occupation. The different soil series follow natural drainage conditions rather closely in their distribution. Soils of the Sassafras and Norfolk series are well drained and occupy low ridges or areas near the main drainage ways. Soils of the Keyport series are fairly well drained and are found on level or gently sloping uplands. Soils of the Elkton and Suffolk series occupy broad flat areas on the uplands more remote from established drainage and are found also in basin-shaped areas around stream heads. Soils of the Portsmouth series, marked by surface accumulations of dark-colored organic matter, occur in upland swamps and along wet stream margins. Some areas have been artificially drained. Tidal marsh and dunes and are not occupied agriculturally.

Soil and crop maps were made of three areas. The Churchland area, representing conditions between the Elizabeth and Nansemond Rivers; the Diamond Springs area, representing those between Elizabeth River and the Atlantic Ocean; and the Onley area, representing conditions in the central portion of the Eastern Shore of Virginia. Both spring and fall crop maps were made to show the year-round crop occupation of the different soils.

From these maps it appears that—

Well-drained sandy loam and fine sandy loam soils are strongly preferred for the growing of truck crops.

In the Norfolk district the Norfolk fine sandy loam is the most extensive and most important trucking soil. The Sassafras fine sandy loam is much less extensive, but is highly esteemed for truck crop production. The Sassafras and Norfolk coarse sandy loams are of small extent, but are extensively occupied for the growing of both summer and winter truck crops. Loam and gravelly loam soils and even fine sandy loam soils of the Keyport and Suffolk series require artificial drainage to become fitted for truck crop production, but are then suited to such crops as potatoes, cabbage, and kale.

Potatoes constitute the leading crop in acreage in the Norfolk district, cabbage and strawberries are very important crops, and spinach and kale constitute the chief winter crops. A large number of less important crops are grown, including beans, peas, cucumbers, cantaloupes, beets, turnips, radishes, and other minor crops.

On the Eastern Shore of Virginia the Sassafras sandy loam is the most extensive and important truck soil. The Keyport sandy loam and Sassafras fine sandy loam are also extensively used.

Potatoes constitute the most extensively grown crop, sweet potatoes are second in importance, and strawberries, cabbage, and onions are the other important truck crops.

The Norfolk district is marked by year-round trucking; the Eastern Shore district is characterized by the growing of a potato crop in early summer, the land being occupied by forage crops after the potatoes are harvested.

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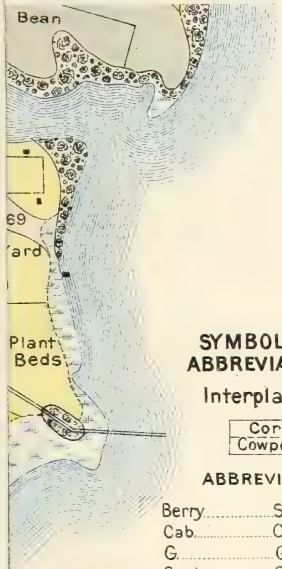

SYMBOLS AND ABBREVIATIONS

Interplanting

Corn
Cowpeas

ABBREVIATIONS

Berry	Strawberry
Cab.	Cabbage
G.	Garden
Orch.	Orchard
Sweets	Sweet Potato
Spin.	Spinach
T.P.	Turnip
House and Yard	
Church	
Swamp	
Canal	
Forest boundary	

Y - Yard

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CURTIS F. MARBUT, IN CHARGE SOIL SURVEY

SOIL AND CROP MAP

JUNE 1916

VIRGINIA
CHURCHLAND SHEET

LEGEND

- Sassafras fine sandy loam — 43
- Norfolk fine sandy loam — 6
- Keyport fine sandy loam — 44
- Norfolk fine sand — 32
- Suffolk fine sandy loam — 69
- Portsmouth loam — 13
- Loamy sand — 38
- Steeply sloping land chiefly forested
- Tidal marsh
- Y - Yard

SYMBOLS AND ABBREVIATIONS

Interplanting

Corn
Cowpeas

ABBREVIATIONS

Berry	Strawberry
Cab	Cabbage
G	Garden
Orch	Orchard
Sweets	Sweet Potato
Spin.	Spinach
T.P.	Turnip

House and Yard
Church
Swamp
Canal
Forest boundary

Surveyed by J. A. Bonsteel of the U.S Department of Agriculture.

Scale in feet

1000 500 0 1000 2000

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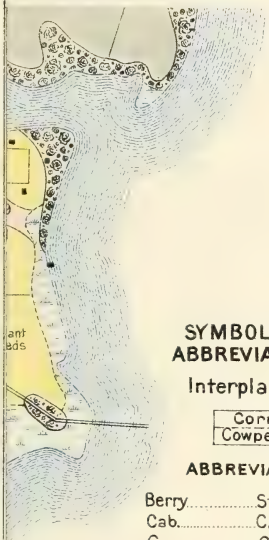

SYMBOLS AND ABBREVIATIONS

Interplanting

Corn
Cowpeas

ABBREVIATIONS

Berry	Strawberry
Cab.	Cabbage
G.	Garden
Orch.	Orchard
Sweets	Sweet Potato
Spin.	Spinach
T. P.	Turnip
House and Yard	
Church	
Swamp	
Canal	
Forest boundary	

Y - Yard

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SOIL AND CROP MAP

AUGUST 1916

VIRGINIA
CHURCHLAND SHEET

LEGEND

Sassafras fine sandy loam — 43

Norfolk fine sandy loam — 6

Keyport fine sandy loam — 44

Norfolk fine sand — 32

Suffolk fine sandy loam — 69

Portsmouth loam — 13

Loamy sand — 38

Steeply sloping land chiefly forested

Tidal marsh

Y - Yard

TRUE NORTH

SYMBOLS AND ABBREVIATIONS

Interplanting

Corn
Cowpeas

ABBREVIATIONS

Berry	Strawberry
Cab.	Cabbage
G.	Garden
Orch.	Orchard
Sweets	Sweet Potato
Spin.	Spinach
T.P.	Turnip
House and Yard	
Church	
Swamp	
Canal	
Forest boundary	

Western Branch

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Scale in feet

1000 500 0 1000 2000 3000

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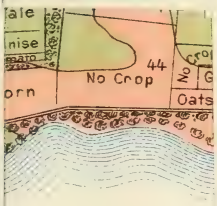

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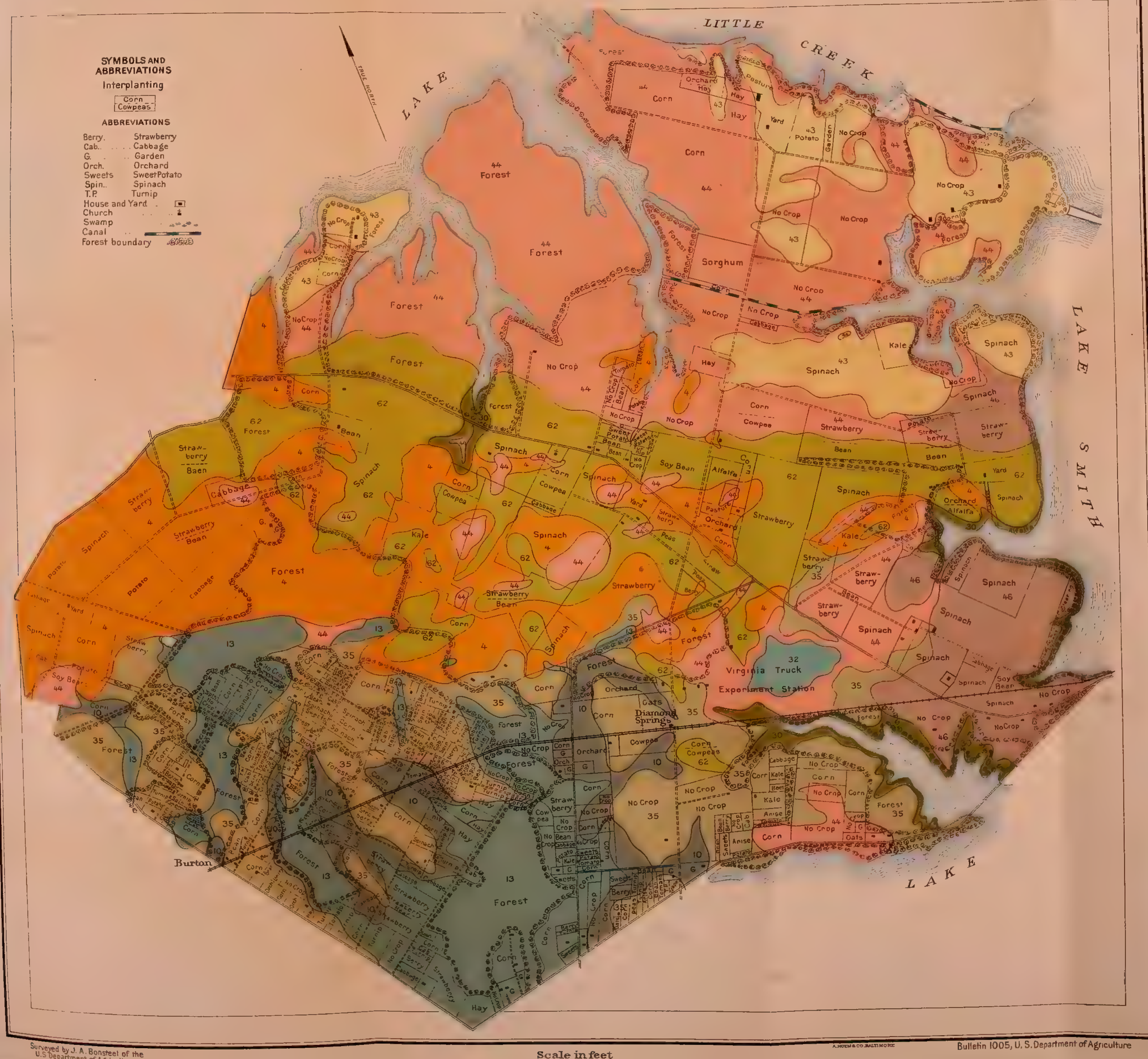
SOIL AND CROP MAP

NOVEMBER 1915

VIRGINIA
DIAMOND SPRINGS SHEET



LEGEND

- Sassafras coarse sandy loam — 62
- Sassafras fine sandy loam — 43
- Sassafras loam — 46
- Norfolk coarse sandy loam — 4
- Norfolk gravelly sandy loam — 30
- Norfolk gravelly loam — 35
- Norfolk loam — 44
- Norfolk silt loam — 32
- Suffolk loam — 13
- Suffolk gravelly loam — 10

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Scale in feet

1000 500 0 1000 2000 3000

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SOIL AND CROP MAP

JUNE 1916

VIRGINIA
DIAMOND SPRINGS SHEET

SYMBOLS AND ABBREVIATIONS

Interplanting

Corn
Cowpeas

ABBREVIATIONS

Berry	Strawberry
Cab.	Cabbage
G.	Garden
Orch.	Orchard
Sweets	Sweet Potato
Spin.	Spinach
T.P.	Turnip

House and Yard
Church
Swamp
Canal
Forest boundary

TRUE NORTH

LAKE

LITTLE CREEK

LAKE SMITH

LAKE

Burton

Diamond Springs

Virginia Truck Experiment Station

LEGEND

Sassafras coarse sandy loam	62
Sassafras fine sandy loam	43
Sassafras loam	46
Norfolk coarse sandy loam	4
Norfolk gravelly sandy loam	30
Norfolk gravelly loam	35
Norfolk loam	44
Norfolk silt loam	32
Suffolk loam	13
Suffolk gravelly loam	10

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1000 500 0 1000 2000 3000

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SOIL AND CROP MAP

JULY 1916

VIRGINIA
ONLEY SH[illegible]

Surveyed by J. A. Bonsteel of the U S Department of Agriculture.

Scale in feet
1000 500 0 1000 2000

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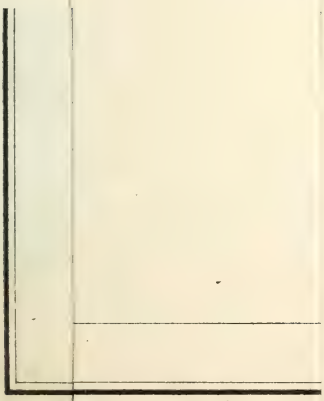
3000

U S DEPT. OF AGRICULTURE
BUREAU OF SOILS
MILTON WHITNEY, CHIEF
CURTIS F. MARBUT, IN CHARGE SOIL SURVEY

SOIL AND CROP MAP

SEPTEMBER 1916

VIRGINIA
ONLEY SHEET

ONLEY

N.Y.P. & N. R.R.

TRUE NORTH

SYMBOLS AND ABBREVIATIONS

Interplanting

Corn
Cowpeas

ABBREVIATIONS

Berry	Strawberry
Cab.	Cabbage
G.	Garden
Orch.	Orchard
Sweets	Sweet Potato
Spin.	Spinach
T.P.	Turnip
House and Yard	
Church	
Swamp	
Canal	
Forest boundary	

LEGEND

Sassafras sandy loam — 37

Keyport sandy loam — 8

Elkton sandy loam — 29

Elkton loam — 51

Portsmouth sandy loam — 57

Y-Yard

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